WILSON'S PHOTOGRAPHICS.

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PHOTOGRAPHICS:

A SERIES OF LESSONS,

ACCOMPANIED BY NOTES,

ON ALL THE PROCESSES WHICH ARE NEEDFUL IN THE

Art of Photography.

BY

EDWARD L. WILSON,

EDITOR OF THE "PHILADELPHIA PHOTOGRAPHER," "PHOTOGRAPHIC MOSAICS," ETC.

The camera is mightier than the pen or the pencil.

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TO MY EXCELLENT FRIEND,

Washington Irving Adams,

IN ACKNOWLEDGMENT OF THE MODEST AND UNOSTENTATIOUS WAY IN WHICH HE
HAS DEVOTED HIMSELF, FOR OVER TWENTY-FIVE YEARS, TO THE

GROWTH OF AMERICAN PHOTOGRAPHY,

BY SECURING AND PROVIDING THE WHEREWITHAL TO PRODUCE THE BEST
RESULTS IN THE BEST AND EASIEST WAY.
THIS BOOK IS INSCRIBED
IN THE NAME OF, AND FOR, THE WHOLE CRAFT,

BY THE AUTHOR.

PREFACE.

PHOTOGRAPHY grows so rapidly, and so continuously widens its usefulness, that an occasional lesson-book must be issued in order that the working votaries of the art may keep at least alongside. During an intimate connection with it for over twenty years, nearly eighteen of which have been expended in the very whirl of its progress,—indeed, with an earnest shoulder at the wheel,—I have preferred to assist my colleagues to do the business of book-making, rather than attempt it myself, owing to the very profound sense I have always had of the responsibility and of the magnitude of the undertaking. The time, it seems to me, has come, however, when I must speak out, and no longer neglect to take my share in this matter. What follows, then, is the result of my efforts. It is for those who read such productions to decide how satisfactorily (or otherwise) I have executed the work.

I have planned it after a scheme "different" from the usual one. It would have been easier for me to have gone on in one continuous strain from beginning to end. But so full am I of the imbibings of these twenty years, that were I to attempt such a course, the good and generous words of my co-laborers would ooze and flow out to that extent that in a little time I would be branded as the most shamefaced and intensest plagiarist. Therefore I agreed with myself in the beginning that I would tell what I knew from experience in simple language—this for the benefit and instruction of the beginner—at the heads of the pages, in bold and honest type, and then in the smaller and more dignified letter following, elaborate with the extended ideas of those who have accelerated the advancement of our art by their discoveries, their practice, and the publication of their experience. As many of these are given a fair chance to agree or disagree with me as I could well work in. I am sorry I had to leave anybody out. I first wrote my own story, and then I set me to the weariness of research—which was the hardest task of all—through volumes of books and magazines, my long-used helpers. And after all, how little I have been able to use of the good which has been so freely given! You would tremble if you only knew how much larger this volume *might* have been made. And it is due to these helpers that I should say more, besides appending a list of their distinguished names. I have drawn from them without regard to their rank or riches, except as to the richness of what they tell.

And to these noble men and women who have assisted me in all these years to hold up the photographic colors, pure black and white, while the "fine arts"

fired at and besieged us with their sarcastic shot and shell—while the world-tide was grinding and beating against us, I give all honor and praise. While I tried to infuse enthusiasm into others, they encouraged me to cheer and lead. I have in every possible instance added their names also to their helpful words.

In studying *Photographics,* I would advise the beginner to read the coarser type continuously first. It will give him about all that he needs to begin work. As he progresses, he may appeal to the wide experience of my worthy co-workers for more light.

I disclaim all originality in this work. I do not remember to have ever made an "original discovery" in photography in my life except one, and that you will find in proper place in these pages. I have prepared my work on this peculiar plan because it struck me as the best, though through my life I had intensely ***hated*** books with foot-notes, until I read the following lines from Butler:

> "Then why should those who pick and choose
> The best of all the best compose,
> And join it by Mosaic art
> In graceful order, part to part,
> To make the whole in beauty suit,
> Not merit as complete repute
> As those who, with less art and pain,
> Can do it with their native brain?"

Since then I have come to appreciate the work of the author who consults wiser heads than his own, and I come into his plan with due humility.

I have yielded to the touching request to accompany my work with my own portrait. I do it, and in sitting for it tried to look cheerful about it. I did it because the picture does credit to one of our most able and patient veterans, Mr. F. Gutekunst, of Philadelphia, and because it serves as an example of ***angular composition*** in illustration of Lesson A. The prints are by the phototype process, fully given in Lesson X. A better and a beautiful example of this class of work is also given further on, in a plate showing eleven positions of the graceful elocutionist, Miss Adelaide Detchon, which must serve as useful studies in the line which I so earnestly desire to see more followed by the enterprising and cultured band of men and women in whose hands and power photography and my *Photographics* now rest for their future welfare. Nearly every other illustration in *Photographics* was made by a photographic process of engraving, and therefore is entitled to be considered as a "sun-picture."

My excellent printer and tasteful binder have done their best to help make our work a good example of the art of book-making.

May it all do much towards the advancement of blessed photography.

EDWARD L. WILSON.

PHILADELPHIA, May 1st, 1881

INTRODUCTION.

WHEN the Divine Master had "created the heaven and the earth," He said, "let there be light: and there was light." Then man was made, who by the genius given him promulgated "the fine arts." But, as "in the beginning," the things pertaining to "the heaven and the earth" needed *light*, to give them life, and vigor, and vim, and snap, and growth, so "the fine arts" needed photography to infuse the elements named into them more thoroughly than they had ever possessed them up to the time of the birth of the *greatest* of arts, forty years ago or more, at whose shrine we are the favored devotees. And we all know that they use it and are familiar with what it has done for them, and how they do lean upon it for courage and help.

Is it worth while, then, to take up time and space with a lengthy "introduction" to what follows, when every household is already so familiar with the workings of photography, that it is only a question of a little time when the camera and the lens will be as much a part of home-diversion and enjoyment as the printing-press and the scroll-saw now are, and ten times as pleasure-giving and refining in its influence?

Yes, photography is already *popular* among the masses, full of advantages to them, and dearly beloved because of its undenied truthfulness, and the knowledge and happiness which it brings into the family. It is a willing helper and an indispensable one in almost every direction. It lifts its searching eye to the heavens and brings the wonders of the planets to our drawing-rooms; it sends up its sensitive messengers away above the clouds and they gather revelations which mystify and confuse the senses; it creeps back into antiquity and reveals the histories of the periods long before the Saviour came; it takes up the bit with electricity, speeds alongside and compels it to share its mysteries; it grapples with the invisible musicians of the air and wrestles from them a record of their own sweetness; it goes hand-in-hand with the microscope, and helps it fill the world with wondrous revelations; it has driven the old-time lecturer from the platform, and serves as the right-hand helper of the modern one, by illustrating his topic through the lantern; it dives down into the sea and comes up smiling with a rich revelation of what lies beneath; it throws hot coals upon the heads of the "fine-art" devotees who fain would crush it, by giving them reproductions in size, color, and *feeling*

of the drawings of the old masters; in book and magazine illustration it has wrought a revolution; it cheers the emigrant on his way, it helps hold the memories of the dead dear ones ever fresh, and it comforts the sorrowing in all lands—the rich and the poor; it delves down into the bowels of the earth and brings up the glittering likeness of the stalactite and the grim stories of the catacombs; it is a household necessity and a public comfort. And yet, important, helpful, unassuming, enterprising, useful, indispensable as it is, photography claims to no perfectionism. It is a g-r-e-a-t sinner, and yet it grows and grows—never grown—on it grows.

The great Alexanders of science and discovery need not weep because there are no more conquests to make. Photography not only opens up a wide field yet for research—because its necessities are still great—but it offers a large enough tract free of all incumbrances to satisfy the wildest enthusiast. *Oh, come!*

What more can be said for it now, unless it be that ye who will read the instructions embodied in the lessons which follow, may live to see many of the terms and processes therein given rendered obsolete by "future improvements"? No one will dare say that we yet have even an approach to "*the* process of the future."

Take up Hunt's *Researches on Light* (1854) and you will read of the "solar phosphoir" and the "dentiodides" and the "epipolized light"; descriptions of the "cyanotype," the "callotype," the "aurotype," and the "agarics"; the wise words of Becquerel and Bockman and Sir J. Herschel and Niepce and Davy and Daguerre and Talbot and a host of others. These are all gone with the past. *Photographics* with its list of wise ones comes in now, and it is proposed to leave it with you; for after all, an "introduction" will be of no service perhaps, since, when appeal was made to Mr. Hunt's "introduction" to see what he had to say of our art as it was twenty-seven years ago, it was found that in a copy which had been through all the stages of use and abuse, and at last turned up in, and was rescued from, a second-hand book-store in London, the leaves of the "introduction" had never been cut! One appeal then. Give *Photographics* a chance on its *introduction* at least, if you go no further.

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WILSON'S PHOTOGRAPHICS.

LESSON A.

TREATMENT OF THE SUBJECT.

1. THE one thing which the photographer needs most to consider with greatest care, is the treatment of the subject which comes before him. This he cannot always select; and he has but little time, as a usual thing, to study it, and to decide which is the better way to treat it. The chemicals are all right, and are sure not to disappoint him. Of his manipulatory success he is certain. The camera is at his service, but needs handling with care. The arrangement of the subject, the introduction of background and accessories, the management of the light and shade as well, the harmonizing of the whole so as to produce the best pictorial effect, are the things most apt to puzzle and even baffle him. Let us then consider this part of our subject first.

1. Again, whether the photographer can be called an artist or not, to obtain the highest success he must have something of the education and feeling of an artist. He must know what is beautiful when he sees it, and he must understand in what true beauty and grace in the human figure consist. I have seen many photographs with many capital points about them—good light and shade and general arrangement, the face well done, and the drapery rather good; but, looking under that drapery, as it were, it was quite impossible to judge whether a human being with limbs existed or not. The artist, whether painter or sculptor, more especially the latter, would not tolerate this, and the photographer should remember that the form of the human figure should be seen to exist within the drapery, giving the picture vitality and character. Any photographer may, by happy chance, occasionally produce a good picture, but chance will not enable him oft to repeat it. I have sometimes conceived a picture, for the means to embody which I have had to wait for years; but as I could see my picture in my mind, I knew at once when the possible or suitable model for it was accessible to me, and so seized the opportunity, and got what I wanted.—O. G. REJLANDER.

2. There is no cause for despair, no reason for faltering in this delicate and difficult portion of our art's work. We may learn to "produce beauty by rule." Before photography was born, *art* was. It was agreed by its masters that it should be governed by certain laws or principles, which were to hold good in all its departments and in all their phases. Poetry, music, painting, sculpture, architecture, dancing, all fell into line, and accepted these principles at once, in the production of the delights which everlastingly come to us from them.

3. Young photography, therefore, if it would take its place among the arts, must willingly bury its indifference, and come into the procession under the rules which govern its members, or as many of them as apply to it. What these rules are, it will be the purpose of the paragraphs which follow to explain and illustrate.

The department of portraiture will be given the first attention, for what

2. For my own part, I lose sight of considerations as to the mechanical appliances, except so far as they require to be accommodated to the necessities of the picture. The rough instrument ceases to exist for me, absorbed as I am by the idea of reproducing my ideal. Where there is a will there is a way. In photography, as in art, when the sentiment is energetic, it can never be sterile.—ADAM SALOMON.

In learning the rules for composition, as in all other departments of art, the artist must study nature to find his fundamental principles, and in doing so, he will learn, that in accordance to this law of unity of the mind, but one feeling or sentiment is directly and decidedly addressed by any one production of nature. Flowers having the strongest perfume, like the orange, jasmine, and lilac, are either white, or most delicately tinted. In the charms displayed by the gorgeous lilies and tulips, the eye alone is gratified. Brilliant birds are never great singers. People who are regularly beautiful are not gifted with strong mental capacity; for, according to the laws of harmony, strength of character is too decidedly marked in the physical development, to admit of the delicacy that is essential to regular beauty. We find every degree of strength and beauty, every variety of element, and every possible variety of combination in the human form and character; and, according to the law of harmony that pervades life, we also find that the intermediate combination, that serves to unite and harmonize the two extremes, partaking alike of the character of both, is never wanting.—M. A. DWIGHT.

3. There has always been much declamation about the fault-finding tendency in our customers, but consider where we would stand to-day if nobody had ever found fault with our work. Some of our patrons possibly know nearly as much about good effects as the best of us; at any rate, by trying to see what, and as they see, we shall more fully understand the subject by getting it in a new aspect.

A too much neglected means of advancement is here. The aim should be not solely to please, but to please with the best work. It can be depended on to win in the end. In fact, every one now knows something about pictures, so no one's opinion should be entirely ignored. Good chromos, good autotypes, good engravings, good paintings, good photo-

applies to it will also be of service in the management of subjects of all classes.

4. The reproduction of the human body, so to speak, is the most exalted reach of our art. Man is made by God "after His own image." All the other arts imitate man in their creations. Poetry sings of his loves and passions; music mimics his songs of praise, and repeats his woful wails: the painter never tires of delineating his figure, of representing his life, or depicting his beauties: sculpture immortalizes him; the architect constructs his grand creations in form after the human figure; and dancing moulds his graces into the poetry of motion, thus creating and completing a ring of faithful delineators of human splendors, all bound by the principles of art. They express for humanity its ideas; they render its sentiments: they tell its stories: they imitate it in all its phases, for the enjoyment of its members.

5. Photography is born, and, like a Joseph among his brethren, asserts itself, and demands a place. Its youthful hand is laid upon the glorious circle, and admittance asked. It is denied, and effort made by its envious kindred to hide it in a pit, and to utterly destroy it. Why? *It does not comply with the rules.* Yea, there is a fear that it will itself want to rule over all, and great jealousy arises lest it should out-run them, and destroy

graphs, can be had anywhere; they are educating the million, and it remains for each caterer to the public to study with open eye, brain, and heart, lest he shortly be found not in advance of, but behind, the public taste.—W. J. Baker.

4. The utmost capacity of photography can only be reached when, with complete control of his materials, the operator is possessed of a cultivated mind, is master of the principles which govern art, and deeply imbued with its spirit. Mere taste is not sufficient; he must have thought, too, and thought is the result of culture. Like the architect, sculptor, or painter, he ought to be a man of observation, and able to segregate the essential idea from the unnecessary rubbish which surrounds it. Drawing, modelling, or painting are the means by which poetic ideas are unfolded in plastic art; in photography, the chemical action of some of the rays of light upon a sensitized film or medium stands for two of these, and when, within their proper sphere, they are used by corresponding intelligence, bear corresponding fruits. Their results ought to be preferred to thoughtless skill, for they give better satisfaction.—S. G. Sellstedt.

5. Photographers, in your hands is power. The power of the wonder-world of art. Do not underrate it. But whether it be great or little is of small account. It certainly is real, and, as real, the true artist will have it what it ought to be. He will teach all whom he can reach that in the perfect truth alone is the perfect beauty; that every thing and every person who has a right to be at all has a beauty of its own; that his own aim is simply to discover and most perfectly to render the highest, exactest, and completest life of each; and that, in a word, in the highest character is the perfect art.—Rev. Frederick Frothingham

their harmony and peace. But this must not be so. It *is* not so. For, after ignoring the principles of art for the first thirty years of its life, photography, awakened out of sleep, ceased its obstreperous opposition, and, rubbing its eyes, began to study, to practise, and to improve.

6. As a result, the productions of photography ten years ago are not worthy to be compared with those of to-day in an art sense. Yet there is still more room for progress and improvement in this noble direction than in any other, and its importance cannot be too earnestly urged. What photographers need for themselves is culture—education in the principles of art so far as they are applicable to photography. What they need to secure to their patrons is a likeness; made more beautiful and pleasurable, as it *can* be, by the application of these principles in its production from beginning to end.

7. As in grammar, certain rules regulate the parts of speech which make up our language—as in authorship, the rules of composition govern the forms of the sentences which immortalize the author, so in photography must and do the rules of form, composition, light and shade, govern the production of the best pictures. It behooves the photographer, therefore, to study and practise these rules; to educate the mind and the eye, and

6. The great want in the present position of photography, is a more extended knowledge of art amongst photographers. Were this want supplied, there would soon be an increased taste and refinement in photographic productions. Articles have been written on this subject, but often in a style too philosophical and dreamy, so that the simple soul who wants to know what he should do to improve, and how to do it, is utterly bewildered and confused.—James Mudd.

There are general and specific principles in art, and the better we comprehend them, the more readily do we see the intention of the artist in his pictures. Hence, it is like learning a strange language; we must first begin with the sounds of the letters and words before we can communicate in sentences. Thus in art, if we understand and have acquired the faculty of artistic sight, our gratification is immeasurably increased by being able to appreciate what we see.—L. G. Bigelow.

7. I consider it requisite that a professional portraitist should previously undergo a similar course of training to that which an artist, in the strict sense of the term, would do. A man is not an artist because he possesses a camera and lens. Incapacity will inevitably be made manifest in results—in the miserable productions, in imitation of humanity, which have been scattered broadcast over town and country, plentiful as blackberries in the autumn. But a student devoted to art, bringing to bear upon photography the superior taste and judgment to be only acquired by years of ardent study in drawing and painting, will not fail, in time, to rank with the best men and most capable artists in the profession. These, I have no doubt, have each gone through such a course of training in art as I have referred to, before entering the domain of photography.—R. Slingsby.

to train the hand to conform unto them. Carry into practice what you see, what you imagine, what you invent, and apply your genius and your skill to your work.

8. Some one has said that "Genius plays and talent labors;" that is truly so, but it is only the genius that plays by rule; and the truly talented labor with principles constraining every action. The dancer in his wildest enthusiasm, is swayed by the silent influence of *time*, and the mightiest sledge is swung to the reverberations of the anvil music, or to those of the shaping mass beneath it. Nature herself, fickle as she seems, submits to laws as eloquent as her own fascinations.

9. When a person appears before a photographer for a portrait, if his mind is fraught with the culture which he needs, it will flow from him in generous fulness, like a spring, as if by inspiration, just when he requires it, and of the kind he requires. There is something wonderful about this, but it is true. As soon as the subject is presented, the artist mind, if trained, will begin to work and to simmer, and his knowledge to bubble up to his aid. The pleasure he feels in the work, and that which he hopes to give to his patrons, gives impulse to the power within him. What exists in his model calls up other suggestions, and he goes at the posing and lighting with a will and a conscious strength which surprises him. To produce the conceptions which arise from his mental power becomes his passion. How wildly he would work, did he not permit himself to be swayed by the rules of art; and as poetry without measure, as music with-

8. We need to cultivate the sentiment of the beautiful, a feeling and taste for art, to read the book of nature in all its phases and endless variety. These are the much-neglected subjects that should be more urged and impressed upon the minds of photographers. These are the subjects that elevate, and inspire an ambition to cultivate the taste and a love of the beautiful; they furnish the mental and moral aliment that nerves our energies, and embraces the whole philosophy and secret of success; and as nothing succeeds like success, why is it that so few climb their Parnassus by this enchanted but more difficult road?—D. H. ANDERSON.

9. Whether the artist mean it or not, in every face he photographs he tells a story. If it be the face of an infant or grown child, there is the sweetest of all stories—the story of innocence and strangely bound-up probabilities; if of a fully developed youth, there is the story of school-battle, with life ahead and gray hairs and honor in the distance; or the picture may be a register of school feebleness and an evident life of commonplace events in the future. If we are photographing those who are wearing on into the afternoon of life, then it is when the story may be of most interest. The wear and tear of life, with all the turmoil of passion, has now gained the control, and every line and look has taken its impress from the long line of past action.—JOHN BEATTIE.

out time, so his results would appear when measured by the laws of the beautiful.

10. No more then about the importance of applying art principles to the practice of photography. We admit that, and proceed to the study of those principles as laid down by the "old masters," who themselves submitted to them in the creation of the glorious works which have made them immortal. And let the words of Goethe be our watchwords: "The highest demand that can be made of an artist is this: that he shall hold to nature—study her, imitate her; that he shall produce something resembling her manifestations."

11. That you may be able to discern the beauty and truth of nature, and apply the same in your every-day practice of photography, is the purpose, then, of the feeble instruction which follows. It is the partial outgrowth of years of delightful reading and study and practice amid the works of the immortal ones, at home and abroad, helped by the authorities who advocate their principles.

10. First, I would advise you to study nature; study it constantly, closely, and patiently. Never suppose that you are perfectly familiar with it; the more you study it the more it will reveal itself and its true character: many look and do not see.

Study works of art: paintings, engravings, sculpture, and photography, all demand careful study; and when you examine a picture, do not be content to pronounce mentally even a hasty judgment upon it, saying, "Oh, how beautiful!" or the reverse, but take time. It will well repay you to study out what are its qualities first, lastly its defects; try every line: now this deep shade, this high-light, this mass of half-tone; find out if you can the purpose or intention of the artist in every particular, and if you have the privileged companionship of a more advanced student than yourself, exchange your opinions freely; the advantage of doing so is evident. If your home is in a large city, be grateful for the opportunities its galleries and art repositories afford you for study. If not so favorably situated, take every proper opportunity of seeing any private collections in the neighborhood, or of being introduced to their owners. Generally they are ready to receive kindly those who take like pleasure with themselves in studying works of art. Should no such opportunity be available, do not starve while so much art is to be met with in so many of the wood-cut illustrations of the present day; first-rate art, too, let me tell you—fit to inspire.—WILLIAM NOTMAN.

11. It is an improvement in the right direction, and too much praise cannot be given to our photographic journals and the writers of books on art principles who have made such a persistent effort to impress upon photographers in general the necessity of an art cultivation in lighting and posing. Too much cannot be written upon this point, nor can a photographer study it too much, for here is the touchstone to rank photography among the fine arts. And not till photographers as a class have become art students, and their art knowledge is apparent in every picture they make, can we hope to reach that point. It is true that portrait photography as now conducted has a certain business aspect attached to it that tends to degrade it as an art. This should be kept in the background, and the artistic effect and ap-

12. As a corner-stone to the structure, placed with the greatest consideration, *correctness* should stand pre-eminent. Should the eye be allowed to fall into a loose, imperfect habit of study, it will be found difficult to overcome it afterwards, when you see the folly of it. The first step then towards the education of the eye, is to learn to measure the distances between objects. Next, take in accurately the forms of the lines which bound these spaces, and the shapes which are contained or excluded by such lines. This gives the eye something tangible to work upon. Take a pencil or a brush and make a series of dots. Then draw lines from one to another. Imitate them as near as you can, over and over again, comparing their correctness with the original. Enlarge upon this by making and imitating other forms.

13. Every figure or form holds within it, more or less, portions of a triangle, square, or circle. In order, therefore, to fit the eye for the purpose of seeing such qualities when mixed and combined with more complicated figures, it must be taught to imitate and comprehend such objects

pearance of the gallery made as prominent a feature and study as possible; and as long as photographs are offered to the public by the dozen, so long will it have a commercial aspect. Then photographers as a class are so avaricious; the almighty dollar is what they are seeking, and everything, art and all, is sacrificed upon its altar. So business and photography, by usage, have become very closely allied, and to make the latter recognized among the fine arts will be a very difficult matter under the present regime. But as photographers rise higher in their art knowledge and the application of it, they will have more pride in their efforts, a more generous feeling towards each other (even to their next door neighbor), and a higher love for their *profession*, for business and its chosen god, the almighty dollar, will then have some respect for the photographic art, and kneel to its dictation.—ALVA PEARSALL.

12. One of the very best methods of self-tuition in photography is the cultivation of the habit of comparison. If the photographer is really honest and earnest in his desires to improve (and by improvement I mean the improvement of his finances as well as of his work, for the one is *sure* to follow the other), he will fall into this habit involuntarily, and blessed is he if he does. He will not settle into a rut, and say to himself, "Well, things are going along smoothly, and I will let them alone;" but the rather, "I am going to lift myself out of this and see what is going on outside, even if it does go rough for awhile."

He will, when he picks up examples of the work of others, fall into the good plan of mentally placing it alongside his own, and then going through a course of catechism, *honestly* questioning and *honestly* answering himself. And the result will be, be the examination in favor of his own work or not, that *he will learn something which will prove profitable to him.*—OLD ARGENTUM.

13. In reference to the requirements of art, Goethe has written on this background of the past, "That the highest demand that can be made of an artist is this, that he shall hold to nature, study her, imitate her; that he shall produce something resembling her manifestations. How great, nay, immense, this requirement is, we do not often consider; and even

in their simple forms. Therefore, select some of the objects used in your work having these forms or partly so, and draw from them. Thus your eye will become accustomed to them, and gradually you will fall into the habit of mentally measuring the correctness of the shapes constantly presented to your eyes, and you will have received excellent lessons in the grand principles of *eye education, measurement, and form.*

14. After these come the vastly important lessons of *perspective*, so useful in the practice of photography. Clothed with its geometrical and mathematical intricacies, perspective is a bugbear which "hoodlums" many a would-be art student. The effort will be made here to render it understandable and of service. The Latin derivation is *per*, through, and *specto*, to view; and the drawing in perspective, may be defined as the art of representing various objects subject to those laws which regulate their appearance in nature.

15. As all forms are made up of lines, more or less intricate, their study should engage us now. All of them are subject to variations in their appearance except two—a horizontal line and a perpendicular one. Lines are also more or less diminished in their length as they depart

the true artist succeeds through instinct and taste, through practice and trial, in approaching the outward beautiful side of objects, in choosing the best out of the good before him, and at last learns how to produce an agreeable appearance; how much more rarely does it occur, especially in these later times, that the artist is able to penetrate into the depths of his own soul, as well as to take the measure of outward objects; and thus, instead of producing works of a merely superficial effect, emulate nature herself, and create a spiritually organic whole, giving to his work an import and a form that make it seem at once natural and supernatural."

This may not all be within the grasp of the student of photography, because he deals more with material things, and has not the latitude for idealizing that the painter has; but that photography is susceptible of embodying all the higher elements of true art, the works of to-day, which express so much of poetry and sentiment, abundantly testify.—G. W. WALLACE.

14. The merit of our higher classes of work consists in the adaptation of recognized rules of art to the end in view. Study of perspective, the effects of light and shade, of the graceful disposition of lines, and of the judicious aid of simple accessories, will do more to enhance the value of one's work than the collection of all the receipts ever concocted.—JOHN L. GIHON.

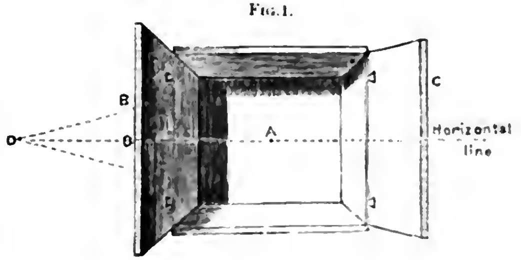
15. First, of course, comes the closest study of nature in all her moods; but, to supplement this, familiarity with the work of her best interpreters is of a certain advantage. I have said that the best likenesses in photography seem out of keeping; the light is so distributed upon them that certain features are too prominent, others too receding. The bridges of noses are widening, the ends made bulbous, and often the neck is without modelling. There are flat spaces and empty spaces. This is not the case in nature. However little there may be in the head, there is plenty of modelling on the outside. Nature leaves no blank, all is finely modelled and diversified.—CHARLES AKERS.

from the parallel of their base-line. Hold a pencil at its centre, by thumb and finger, parallel to the eye: now gradually twirl it around, and it appears to become shorter and shorter, until it is seemingly but a spot, when it is placed with the point directly towards the eye. This is called the *point of sight*, which is always upon a horizontal line and immediately opposite the eye of the observer. Turn it around now, from right to left, or *vice versa*, and points without number may be described along the entire line. These are called *accidental points*, and vary, more or less, as the lines run at right angles from the base-line.

16. Lines also vary according as they are situated above or below the eye of the observer. To prove this, hold up a piece of glass on which a series of lines have been drawn, radiating from the centre, and look through it up a street or along an inclosure. It will be seen that those lines which are at right angles with the base-line, fall in with and cover many of the lines so drawn upon the glass; for, as they run to the point of sight, they will, of necessity, converge, since the spaces between them diminish as they recede from the spectator.

17. The following will illustrate the above points. Let the figure represent a case with folding-doors, placed immediately before the eye. The sides appear to rise and descend to the point of sight, A; also the door, B, from its being opened at right angles with the base-line; while the lines of the door, C, appear to run to the accidental point, D. This point will vary its situation according as the

Fig. 1.



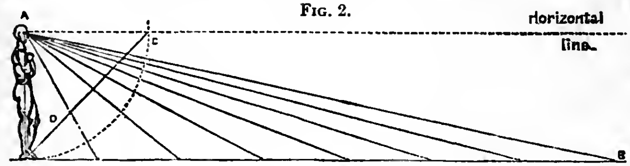
16. Theory is the great director of experiment, the only interpreter of the works of nature which is never wrong; it is our judgment which is sometimes deceived, because we are expecting results which experiment refuses to give; we must consult experiment, and vary the circumstances till we have deduced general rules, for it alone can furnish us with them; and general rules direct us in our inquiries into nature and the operations of art; they keep us from deceiving ourselves and others, by promising ourselves results which we can never obtain.—Leonardo da Vinci.

17. The photographer may further advance himself by the study of good hand-work in the matter of composition or arrangement of his picture. I have not much to say upon so profound a theme as this, and it is hardly necessary to remark that it is the subject of all others which the student can least afford to neglect. It is indeed of the first importance in

door is more or less opened, which explains what are termed accidental points.

18. As we depart from any object, it diminishes in size, apparently. Two parallel lines seem to approach each other as they recede from the eye. This is termed *diminution*, and appears, to a degree, governed by whether the lines commence from a near point or one far removed. For example, a coin or a hand held near the eye will intercept more than when held at arm's length. All objects diminish in an increased ratio until removed to a certain distance, when the diminution appears less violent. Witness the next diagram. Let the line A represent the spectator, and the line B a line of pavement; the circular line C, which cuts through the visual rays as they approach the eye, will show the diminished ratio as the squares become more distant, and, as they have to be represented on a plane surface, their proportions will be as their diversion on D. Their appearance is represented by the horizontal lines in the next figure.

Fig. 2.



19. What is termed *violent perspective* may also be illustrated by this figure. When objects are commenced too near the eye, they appear to be out of proportion with the other objects in the work, and, although

photographic, as in other portraiture, how the figure is placed, how the drapery is disposed, how the head is turned, where the hands shall rest. The least change of action produces a new combination, which may be right or wrong, pleasing or harsh. The old definition of beauty must be kept in mind: variety in unity. It must be done, but the difficulty is how to do it.—Charles Akers.

18. We want to see the time when poor pictures will be rejected by the public as unworthy of their attention. Now what must we do to accomplish this? We must study the principles of high art, and every time we make a picture we should endeavor to portray to the best of our ability the amount of art knowledge we possess; and let me say here, possess all you can, study all the art journals you can get, and particularly study good pictures. I never received so much instruction and benefit from that one source as while at the Centennial. I had never attended a photographic convention, and had no idea of the good they can do. Although I was unable to attend at the time of the meeting, I was greatly benefited by studying the works of our eminent city artists in Photographic Hall.—C. M. French.

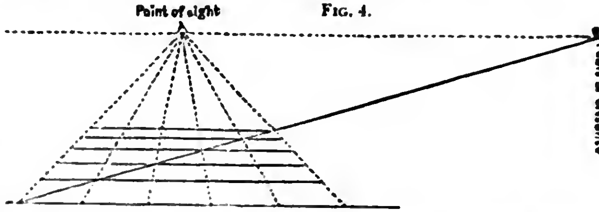
19. Now what has object-teaching to do with this? Why! when you come to look at your sitter you should observe whether you have a pale face, a ruddy, shiny, or a greasy face, and you should recollect that the one will absorb the light and the other reflect it. So you will

according to rule, they appear false in effect to the eye. To avoid this, a point of distance is chosen that will look agreeable. The farther this point is removed the more level the ground will appear, as, by this system of object-teaching, is shown in Figs. 3 and 4.

FIG. 3.

20. ANGLES.—What has been said more immediately applies to *parallel* perspective; so named from all the lines which intersect those running to the point of sight being parallel with the base-line. When, however, a square or any cubical form is viewed at the angle, the two sides will not appear to vanish in the point of sight, but run to two points on the horizontal line, called vanishing-points; and this mode of treating the subiect is called *angular* perspective. Now, these two points are always at an equal distance from each other, which is one-fourth of a circle, therefore, if one is determined upon, the other is easily found; for as one departs from the point of sight the other appears to approach it, as one may perceive by turning around a sheet of paper, or a book, from a situation where one side is parallel with the base-line until it is viewed upon the angles.

FIG. 4.

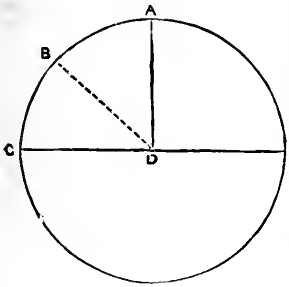


have to study your faces to know how much light to give in each case. You want to know how to get enough light, and not a great deal of light, but the right kind of light, on the subject. Remember that light travels in straight lines, and that even the atmosphere will drive it from its course. That is the reason why a high skylight causes more diffusion of the light, and gives softer results than a low one.—EDWARD L. WILSON.

20. The old-fashioned *silhouettes* represented nothing but the outlines of the picture, and yet they were very charming. This shows of how much importance outlines are. Their influence is felt in every picture. Every thinking artist who desires to reproduce an object, first studies its outlines. He allows his eye to glide over the lines, and tries to find the beauty of their curves. He follows the changes of the stronger and the weaker ones, the longer and the shorter, their windings and their easy combinations.—DR. H. VOGEL.

21. The cause of this may, perhaps, be more clearly explained by the following: Suppose the circle to represent the line of the horizon, which is the true representation of it when viewed out at sea, or where no obstructions intercept it, for then the water, coming in contact with the sky, presents a circular horizontal line. If a person, therefore, was placed at D, and looking to the point A, the line C would be parallel with the base, being at right angles with A, and consequently occupying one-fourth of a circle; but if he turned in the direction of B, then A and C would become vanishing-points, though still at equal distances upon the horizontal line, and would appear as in Fig. 6. In a panorama, which is a circular canvas viewed from the centre, this mode of measuring the various points is found to agree perfectly with the natural representation of objects.

FIG. 5.



22. CIRCLES.—If any one takes a drinking-glass or cup in his hand, with the mouth of it towards him, and gradu-

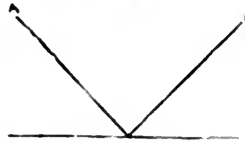
21. Photography is a means to an end. By its aid we are enabled to secure representations of *realities* visible to the human eye. Pictorial *art* in photography consists in making such representations artistic and pleasing productions.

In what way should the student who wishes to excel in the art commence his practice? I will suppose him to have mastered the chemical and mechanical difficulties connected with photography through its first stages, and that his earnest endeavors for the future are to be devoted in acquiring a perfect mastery of the various subjects to be photographed. A knowledge of drawing is, if not essential, a most important requisite, proficiency in which will enable him to design a suitable arrangement for the sitter beforehand, whenever an important work may be required, thus taking a load off the mind when the actual moment arrives; such is frequently my practice when wishing to produce a picture out of the usual style. A continued method of noting in the mind the beauties of nature and art is valuable, the artist not allowing himself to pass quietly by any of the fleeting effects in nature, or to neglect any beautiful pictures he may chance to see, without arriving at a conclusion in his own mind as to what constituted the charms which have arrested his attention. He should learn to look on nature as if looking at a picture; this in time will have its effect, if persevered in by the student, in aiding the first step in art, which is the proper cultivation of the eye. A cultivated eye and taste will decide what forms to arrange, and also what light and shade to throw upon them. Practice alone can enable the student to equal his own ideas. It is a great thing to keep the judgment ahead of the practice, so that every succeeding work may present an improvement upon the last.—R. SLINGSBY.

22. Without the eye being made acquainted with the beauties of those who have advanced the art to its present state, either progressively, by studying the best works, or by

ally turns it from him, carefully watching all the elliptical forms until the brim becomes a straight line in appearance, he will have a correct idea of how it is that columns or other circular objects assume an oval shape at top or bottom, according as they are above or below the eye. Or if he holds the cup with the side downwards and turns the mouth gradually round towards him, he will see why arches or circular gateways appear elliptical in a side view. It arises from parts of the circle being more foreshortened than other parts; that is to say, those lines which come more in the line of the visual rays. This can readily be illustrated with your lens-tube.

FIG. 6.



23. The application of these principles is easy to every one who knows how to operate a camera. And in applying them, remember that the base upon which all the rules of true drawing are founded, is what has been explained above. And above all, keep in mind that all horizontal surfaces of objects diminish in breadth as they approach the horizontal line, and regain their true width when they depart from it, either by being immediately above the eye or directly under it. This rule applies to all flat surfaces; and this is why surfaces of objects whose lines are at right angles with their base-line increase in length as they depart from the point of sight, either to the right hand or to the left.

commencing a course of drawing from antique sculpture, it will be impossible to select what is beautiful in nature, or be able to choose one point of view more interesting than another. It will also be impossible to combine a variety of objects, unless we have a knowledge of those principles upon which the various works are constructed that have given satisfaction; for though, as in the case with music, the varieties are endless, yet the science is simple, and to be perceived by those who investigate the arrangements of harmony. He who attempts to study from nature unassisted by education, in the first instance, will find himself often mistaken in his results; neither will he arrive at so certain or so expeditious a method of delineating objects with truth and feeling, as he will be continually in dread of falling into error.—JOHN BURNET.

23. I do not hold it to be at all requisite that the photographer must be a complete analytical chemist, a profound physicist, or that he should be capable of solving the most intricate of the optician's problems; but I do maintain that he should have a general comprehension of all these sciences; that at least he may remark intelligently upon the accidental incidents that occur in his working, and so profit by them. In fact, I am even one of those who uphold that the superior excellence of a photograph can now be best attained by devotion to art and its principles. These must be studied with the same assiduity given to the understanding of the chemicals.—JOHN L. GIHON.

24. When the mind is fully informed of the variety of courses operating upon lines so as to change their appearance to the eye, natural objects should be contemplated with the various changes produced in their forms by their situation. The eye thus becomes familiar with these alterations and the mind enriched by a variety of examples. *Faces* and figures should be specially and continuously studied by the portrait photographer, and the rules just laid down applied to them as they are measured and estimated. As they move before you, you not only notice the changes which occur, but you make yourself acquainted with the causes of such changes.

25. In illustration of this, a face has been photo-engraved with a line drawn straight down the centre of it from the forehead to the chin, and which, you will perceive, when viewed directly in front, as in No. 1, presents a straight, perpendicular line, though actually full of undulations from passing over the entire profile. But as those projections and recedings of the lines are immediately under each other, they reach the eye in the same manner as if a string was held up perpendicularly in front of the face. If, however, the

FIG. 7.

24. Must we admit that our calling is so low down in the scale of human occupation as not to require that mental training and preparation necessary in every occupation requiring the exercise of the least taste or capacity? Then let us not invite that verdict at the hands of the public by flaunting our lack of information in its face, bringing our calling into disrepute, and ourselves into ridicule.

Too many photographists judge their work as a mechanic estimates a piece of nicely adjusted machinery. The higher elements of his art, shades of character, feeling, and sentiment, seem to be utterly and naturally lost upon one whose education, in his profession, has been limited by neglect or indifference to simple results of the dark-room. Is any real artist satisfied with a delineation merely of the physical conformation of his subject? If so, his work does not rise higher than a mechanical operation; his genius is only brought into play in portraying mind, soul, sentiment, and those attributes that bring his subjects nearer to their creator.

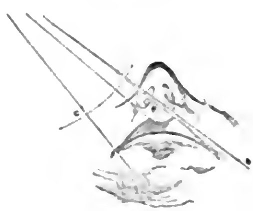
The photographist can never rise to the real dignity and requirements of his profession until he makes himself acquainted with the feelings, tastes, and sentiments of the true artist. —D. H. ANDERSON.

25. Photographs will eventually be stamped with as strong individual character as the canvasses of Rubens and Titian. Such study as the painter bestows cannot be given to photographic portraiture; but in the matter of lighting the sitter, what background he shall have, what accessories, *what attitude*, there is an infinite choice and room for any amount of

face is viewed when turned round half-way, as in No. 2, those parts of the line which recede or project will assume one-half of their true character and projection, while in the profile No. 3, the line acquires its exact similitude, from its being undisturbed by those laws which govern perspective. If we were to proceed and examine each feature in the same manner, we should find that the same laws lead us into a correct view of the alterations which take place upon every alteration in position.

26. To explain this more clearly: If we take one of these faces (borrowing an illustration from Burnet again), and hold it with the chin towards us, so as to observe the curve on which the mouth is placed, we can easily perceive that a person viewing it in the direction of the lines A B, which would give him a view of the face between a front and a profile (or, what is generally termed, a three-quarter), would see one side of the lip of its entire length; while the other side, lying in the direction of the visual rays, would be reduced to a very small space, as may be perceived by its breadth on the ideal line C, which cuts such rays at right-angles. Such also is the case with the nose in the same view of the face; one side remains undiminished, while the other side forms a mere outline, being seen entirely under the influence of perspective.

FIG 8.



27. It is now the purpose of what follows to point out how and when

originality in style. The art is yet in its infancy, and already many photographers of artistic temperament are beginning to be felt in the character of their productions.—CHARLES AKERS.

26. If every photographic artist could have one of Titian's portraits hanging in his studio, the result would soon be seen in our likenesses. In these portraits there are no dead surfaces, there is no distortion; the soul looks forth from its windows with a lofty tranquillity.—CHARLES AKERS.

27. There are many examples of the great masters with whose works all artists should be familiar; and the remembrance of these will always stimulate and suggest invention. In arranging living models, however, no artist will succeed if he attempt to imitate pictures. Each subject should be treated according to its own requirements—its own individualism But a knowledge of good works will aid invention, and it will be found that one subject may be treated with advantage after the style of one master, and another after the style of another. One subject would inspire a Titian, another a Raphael, a third Vandyck, and others in succession—a Velasquez, a Lawrence, a Rubens, a Reynolds, or a Holbein.

When the artist is interested in his work, and believes in his art, it becomes wonderfully plastic, and the materials wonderfully tractable in his hands.—ADAM SALOMON.

a knowledge of the foregoing principles can be of service in photography. It is done with many a foregone conclusion that the camera cannot err, and that whatever is rendered by its aid must, so far as drawing is concerned, be faultless. This is undoubtedly a mistaken idea; and even if we were to admit the instrument to be faultless, what of the photographer?

28. It has been stated that if a pencil or stick is held parallel with the eyes, and gradually turned round, it will seem to become shorter and shorter. The recollection of this principle will be found of much value in the practice of photography. Every part of a picture is more or less influenced by it, and very objectionable features may often be much modified by its proper use. One illustration will suffice, and will suggest to the intelligent reader many others. For example, if you have a lady with broad, square shoulders as your sitter, if taken parallel with the camera, the fact of her having broad, square shoulders will be rendered to its full extent; but if the same figure be turned so as to give a three-quarter, or sometimes a profile view, it will be found to lessen the peculiarity, and more graceful lines will be obtained.

29. It has also been stated that all objects diminish in size as the spectator departs from them, and in an increased ratio, until removed to a certain distance, when the diminution appears less violent; and, that when objects are commenced too near, they appear out of proportion with the other objects in the work; and, although true according to rule, appear false in regard to their effect upon the eye of the spectator. This ought to suggest the advisability of using a lens that will allow of its being placed at a proper distance from the sitter or object which is being photographed, and thus avoid giving undue prominence to any part. This is so apparent in its application, that any illustration is unnecessary, yet do not overlook an error which not unfrequently occurs by violation of this rule.

28. The art of photography is essentially a work of selection. The photographer does not possess the power of the artist, who, in painting, can make alterations in composition and vary his effects during the progress of the picture. In photography it is the opposite; everything must be settled beforehand, or the production, if not satisfactory, must be set aside and the work be commenced anew. A quick appreciation of correct contour of line, with a good knowledge of composition, and the means in readiness to produce a suitable chiaro-oscuro in character with the subject, combined with the ability to select the most favorable view of the model, joined with an easy manner of doing the same without flurrying either himself or the sitter, are some of the main essentials necessary in the practice of a photographic portraitist.—R. SLINGSBY.

30. Heads of children are large by nature in proportion to their bodies, but this is often considerably increased when their portraits are taken by photography, and arises from their being short of stature. They are generally *under* the eye of the camera, and as short-focus lenses are mostly used for children, to secure speed in working, that again necessitates the camera being placed near the child, and thus being near, and looking down on it, the natural consequence is that a picture is produced in which the head is enlarged and the figure dwarfed. The remedy for this is, use a very low stand for your camera, or elevate the child so as to bring the lens at least parallel with the face.

31. CIRCLES.—A glance now at what has been said under this head. Considering how many curved lines there are in the drawing of a face, it will naturally suggest itself, that a thorough knowledge of how those curved lines are affected by the laws of perspective must be of great importance to the photographer, for it has been explained how a circle, such as the mouth of a drinking-cup, or that of a lens-tube, when held in front, by simply turning it gradually away, the circle will be seen to assume an oval, and pass through all the elliptical forms until the brim becomes a straight line in appearance.

Thus it is evident that faces which are naturally too round, by being more or less turned away from the camera, may partake more of the oval. It is surprising how much can sometimes be done by attention to this rule, not only affecting the face as a whole, but when applied to in-

30. Any good photographic artist will be found to have his ideal, just as any good painter or sculptor—an ideal towards which he is striving, and from which he is always remote. He wishes to interpret the inner truths of nature; the impossible tempts him. He points his camera, like Giotto's tower, towards the infinite. And no one knows better than he that he cannot rely upon his instruments, that cameras and chemicals are but means of growth; that for all finer results he must depend upon himself.—CHARLES AKERS.

31. In lieu of a note from a wiser pen, permit an anecdote here illustrating this last point. A lady with a *cast* in her eye applied to an artist of fame for a portrait. He chose a profile view of her face, of course. Upon being remonstrated with by her, he politely answered, "Well, madam, to tell you the truth, there is a *shyness* about your expression that is as difficult in art as it is beautiful in nature." And he was perfectly true to his artist-nature in trying to overcome this "shyness" the best way he could. Take a lesson from this.—EDWARD L. WILSON.

32. Without any reference to the opinions of others, and without any chance of partiality in your own, there is one test by which you can all determine the rate of your real progress. Examine, after every period of renewed industry, how far you have enlarged your faculty of admiration. Consider how much more you can see to reverence in the work of masters, and

dividual features of it. For instance, a mouth that droops at the sides: by selecting some pose that calls for inclining the head slightly forward, as in reading, the lines of the mouth will assume a more pleasing form. Lineal perspective, then, as has been said and illustrated, is that part of drawing which is produced by the means of lines only.

32. *Aerial* perspective is used to designate the changes made in the appearance of objects by the interposition of the atmosphere. By the application of this principle in art, we are enabled to give our drawings the space and retiring character of nature. It is agreeable to view distant prospects, yet objects require a certain definition to lead the imagination without perplexing and troubling the mind. Neither are we pleased by sudden jumps from the foreground to the extreme distance. More delight is given to the eye by being carried over a gradual diminution of many intervening objects, or in searching for outlets through screens of intervening trees or clumps of buildings, or a mass of accessories. If you observe these things, your understanding of them is sure to grow.

33. In thus producing the effect of distance, the atmosphere helps us. Yet the mind requires a certain variety to hold it in amazement, as well as a certain appearance of substance to give a reality to the scene. But if the atmosphere is deprived of the means of refraction by reason of its clearness, a false representation is produced, the effect of which is that objects appear much nearer than they are in reality, and the eye is deprived of the gratification of viewing the outlines of objects through a variety of strengths. This effect may be noticed in portraiture, to a small degree, when a lens of too short focus is used. In out-door work, it is produced by using a very wide-angle lens. The whole scene appears to be produced on a concave surface and the sides stretched and pulled

how much more to love in the work of nature. This is the only constant and infallible test of progress. That you wonder more at the work of great men, and that you care more for natural objects. I fear that the tendency of modern thought is to reject the idea of that essential difference in rank between one intellect and another, of which increasing reverence is the wise acknowledgment. You may, at least in early years, test accurately your power of doing anything in the least rightly by your increasing conviction that you never will be able to do it as well as it has been done by others. That is a lesson which differs much, I fear, from the one commonly taught.—JOHN RUSKIN.

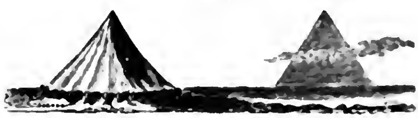
33. Strive to do the best you can for each sitter. Don't expose the plate until you are satisfied that everything is as near right as you can make it. Keep your heart and *mind* on what you are doing. Think! read! study! and observe! Don't be afraid of doing too much, and success is sure to follow.—FRANK JEWELL.

like half of a rubber ball, until the distance is brought almost on a line with the foreground. The difference in definition seems correct, but the distance appears wrong, though perhaps often true to nature.

34. There are six circumstances which may be used to assist the photographer in judging of the distances of objects: 1. Their apparent magnitude; 2. The strength of their shadows; 3. The direction of the two eyes; 4. The parallax of the objects; 5. The distinctness of the small parts; 6. The kind of lens used. In this last, though, is our weakness. Our power is limited to its capacity of rendering detail and distance, while the painter may with his brush "correct nature," or at least more fully satisfy the eye. Still, the application of aerial perspective will often enable us so to work as to keep the several objects in their perspective situations, and secure a natural reality throughout.

35. A row of columns will diminish as they are drawn true to lineal perspective, but it is this quality of light to which they are indebted for their effect upon the eye. Also, two angles may occupy the same space upon the retina, but by this power one is made to approach and the other to recede, so that one is diminished to the size of a tent, and the other increased to that of a pyramid, as in Fig. 9. The student may find subject for study in this art element, wherever he goes, if he will but apply himself to it.

Fig. 9.



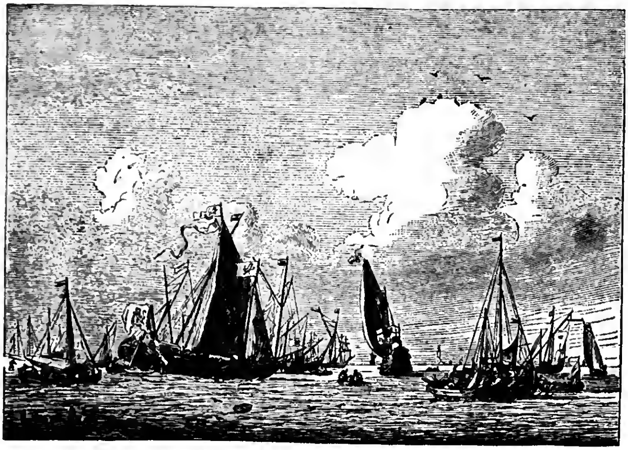
34. Aye, now we are getting at it! Think. Have your mind on what you are doing, and your eyes to see what and how you are doing it. Note the slightest effect or defect produced by this or that change. Proceeding thus, other and greater things will be suggested to your mind, and erelong *you* will know how and what to use for the various negatives you wish to make. Then, too, will the thoughts of others in the different departments of photography render you intelligent assistance, thereby making them your own. Again I say think.—B. Frank Saylor.

35. The real trouble in life, in all professions, is the trouble of thinking; to escape which, the most laborious trifling is caught at, but if fairly grappled with in the outset, everything becomes clear, and, in after life, that which is a continual annoyance to many, becomes one of the greatest gratifications.

Why is it, that to the eye of an artist the drawing of the most complicated plan is rendered clear at a glance, while to others it requires a multitude of figures as reference, and a long explanation? It is, that his mind has been educated in continual intercourse with the eye, and the constant habit of reflecting on cause and effect has rendered a numerous assemblage of lines intelligible to him, which to others, uneducated, appear like a species of hieroglyphic.—John Burnet.

36. In the fine marine view, by Willem Van de Velde, in the Cassel Gallery, there is not only an excellent example of aerial perspective, but also of that assemblage of lines produced by the repetition of forms which assists the receding of objects from their diminution, the doubling of the lines in producing richness of effect, and that harmony which arises from one line counteracting the other in its direction, giving thereby a general balance to the whole. It is hardly necessary to multiply examples. If you comprehend any rule, it is easy to extend it. To those who understand slowly, reflection on one or two diagrams will be of more service than educating the eye without impressing the mind.

FIG. 10.



37. The effect of aerial perspective upon the eye being mainly attributable to the application of shadow to the several outlines, thereby giv-

36. Do not let yourself be a mere imitator, and lose your own individuality. In this way you are in danger of cultivating faults, for if you start out to make pictures like so and so's, you may make them like his bad ones, or may be misled by a reputation above merit. Rather seek to form in your own mind a type of beauty, the approximation to which will stamp all your work with the seal of your individual purpose. Be true to yourself. Admit no half-work; make it your first object to please yourself, or rather to gratify your artistic instincts, and the pleasing of your customers a secondary consideration. There is always a conflict between taste and ignorance; carry it on as courteously as you may, but yield no jot. In time you will be supported by those who really can discern, whose opinion is received by many who do not judge for themselves. When you find that the public have faith in you, keep faith with yourself and them by always doing your best.—W. J. BAKER.

37. Perhaps no class of subjects better exhibit the possibilities of photography than portraits. Here in a well-constructed studio the intelligent artist is comparatively master of the situation. Here he need not grope his way in obscurity, nor lose it altogether in excess of light; for it is under his control. The rays of light which refuse to affect his collodion, he as far as possible excludes from his lens. He has choice. Though the study of composition

ing them their approaching or receding character, such arrangement is to be chosen which will give them this quality, and which is to be afterwards repeated in smaller portions through the piece. In accidental combinations in nature, we often perceive this arrangement. We also find aerial perspective indebted in its effect to the collection of many parts whose shadows form a mass of half-tint, their distance bringing them in apparent contact, owing to their diminutions; while their softness gives them apparent distance, owing to their want of minute parts.

38. Although this splendid principle cannot be demonstrated to the same extent as linear perspective, by rule, it is needful to give it very careful study. True, we must take the atmosphere as we find it—we cannot alter it. Yet if we have our eyes educated to distinguish its different phases, we shall always be enabled to secure the best effects and *know* them when we see them. It varies so much under different circumstances that its study will be found not only useful, but highly interesting,

and chiaro-oscuro is of vital importance in all departments of art, it is here more than ever that he can make his knowledge available. True art looks to simplicity; but to the simplicity which results from abundance, not that which grows out of poverty. In a photograph portrait the interest ought, as in painting, to be centred in the head, for it is the human head, after all, that contains the intelligence which makes man the beauty of the world, the paragon of animals; nothing in art is so difficult to handle with success, and the feeble generally resort to accessory subterfuges, which deceive none but the ignorant, to cover up their faults and shortcomings. As the camera, if well constructed and commanded, need not fail to give sufficiently correct drawing and beautiful modelling, the photographer can well afford to practise the most rigid simplicity. I do not say that accessory details except in bust portraits are inadmissible, but they ought to belong to the subject. In the hands of the man of genius, they enrich; in others, they encumber. This is as true of photography as it is of painting; and the command of the greatest technical skill in one will no more be substituted for real art feeling than in the other.—S. G. SELLSTEDT.

38. Quackery has but too much power. But one thing it cannot do, it cannot keep us thinking the worst is the best. For the moment it may mislead, but only the best will command enduring approval. So we want the best you can give us. We want it to be ever advancing. Your work you cannot make too good. I hold this to be a wholesome and cheering word. It has sure hope for all who are trying to do noble work, and to be thus artists indeed. Let them take comfort. The best work will tell. It will tell even on the quacks. The good worker will get recognition. Good photographers are like artists in any other sphere of life—in sculpture, law, painting, medicine, commerce, preaching—sure, if they will but be patient and loyal, of acceptance and honor at last. But they must bide their time. They must wait until we of the public, ignorant as we are, knowing nothing of their art, save its finished results, have found out that their work is good. Only good work can stand the test. Only good work can keep favor and grow in favor. And once favor sets in for the artist, it is a flowing tide.—REV. FREDERICK FROTHINGHAM.

besides enabling us to determine, to a great extent, the distance of one object from another by comparing the amount of light reflected from each.

39. It is true that in out-door photography this principle comes most into play, but the eye that is accustomed to its study there will be the more apt to discern the best phases and the varied qualities and quantities of light in the studio. The more so now, in these days of rapidly working chemicals and energetic emulsions, to say nothing of the diffusion of focus lenses, which the opticians would have us use. As we are able to work with more speed, we can reduce the amount of reflected light in the picture and secure more softness and mellowness, both in the lights and in the shadows. Between the hazy, lazy, wearied sort of light, and that full of vigor and snap and hardness, there is a rich and delicate medium. Having a knowledge of the principles of aerial perspective, we can distinguish these effects and secure them, to the extinguishment of the defects which often destroy otherwise good photography.

40. It has been the effort thus far to interest you in the rudimentary principles of art, with a view to their practice in the more elaborate branch thereof called *composition.* This embodies the arranging of the various component parts of a picture, so that its general effect may be one of harmony and order. The study of the rules which govern it cannot be too earnestly urged upon all photographers. Their lack of knowledge on the subject has been one of the main hindrances to the recognition of photography as a member of the circle of arts which has already been alluded to.

41. Sound may be brought from a musical instrument by any child, or

39. The photographer's first care should be to study his model before placing it under the ojective's inflexible and undiscriminating eye. Here begins the role of light, with the infinite gradations by which it can indicate form. It is, therefore, of the utmost importance to comprehend the characteristics of the model, and how they may be best rendered, so as to modify the action of light, and thus secure in the portrait suggestions of the true type and character of the sitter.—ADAM SALOMON.

40. It seems to me that a careful study of photography is, after the study of nature, one of the best helps to any beginner in art. It must surely correct that tendency to shirk the hard work in drawing which has been fatal to so many Turners and Claudes. It keeps the multitudinousness of nature ever in mind; it seems to place the vision of a vastly superior eye constantly before us.—CHARLES AKERS.

41. It must, of necessity, be that even works of genius, like every other effect, as they must have their cause, must likewise have their rules. It cannot be by chance that excellences are produced with any consistency or certainty, for this is not the nature of chance;

by the veriest savage; but it would not be music with sweet harmony unless the chords were touched by the skilled and law-abiding hand. It is too much to expect the products of the camera to be artistic, then, unless he who wields it is governed by the principles of art. True, chance pictures are produced with some claim to subject by photographers who do not possess one idea of art: but they are accidental. They should be the rule and not the exception. They *can* be by proper cultivation.

42. As in perspective we find linear and aerial, so in composition we find that which more properly belongs to the lines in drawing—and that which belongs to the light and shade. They are friendly allies, always ready to help one another. Let us consider the first a little further. The photographer having the subject of his picture presented before him, should at once pass through his mind what material he has at his disposal to help him, think of his power to use the same, and conclude upon the final effect which he desires to produce.

43. And in thus composing, he will bring into play the most fit accessories at his command, accepting or rejecting as he finds them to add to, or detract from, the effect of the finished whole. And here as much simplicity as possible is advised, for he is the greatest master, certainly, who produces the most with the least apparent effort.

but the rules by which men of extraordinary parts, and such as are called men of genius, work, are either such as they discover by their own peculiar observation, or of such a nice texture as not easily to admit of being expressed in words; especially as artists are not very frequently skilful in that mode of communicating ideas. Unsubstantial, however, as these rules may seem, and difficult as it may be to convey them in writing, they are still seen and felt in the mind of the artist; and he works from them with as much certainty as if they were embodied, as we may say, upon paper. It is true these refined reasons cannot be always made palpable, like the more gross rules of art; yet it does not follow, but that the mind may be put in such a train that it shall perceive, by a kind of scientific sense, that propriety which words, particularly words of unpractised writers, such as we are, can but very feebly suggest.—Sir Joshua Reynolds.

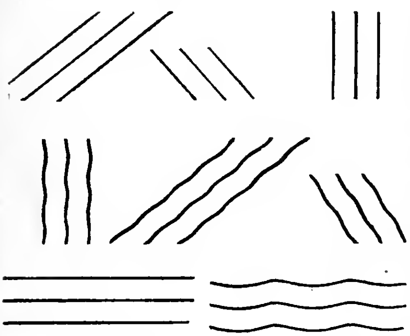
42. Concealing the art is one of its greatest beauties; and he best can accomplish that who can discover it under all its disguises. I ought, however, to caution the young artist, on this head, not to be too fastidious to conceal what can be obvious only to a small number; for in endeavoring to render his design more intricate, he may destroy character, simplicity, and breadth; qualities which affect and are appreciated by every one.—John Burnet.

43. He must have a settled knowledge of what he is seeking; he must have a quickness of eye, to take advantage of accidental arrangements, and a plan of methodizing his ideas, so as to be able to secure what he acquires, without which it will be impossible to produce a composition upon which he can calculate with any degree of certainty as to its effects or its stability.—John Burnet.

44. Before proceeding to take up the various forms of composition which are the most easily demonstrated and most useful in photography, illustrating each method by sketches, permit a few remarks which are applicable to all.

Here is a diagram of the three great varieties of lines which fall more or less into every photographic portrait. It is good practice to reproduce them, by placing your accessories, draperies, and backgrounds into various compositions, and then study them over and over again. The three great classes, then, are as follows:

FIG. 11.



45. UPRIGHT LINES, or lines running upwards, give grandeur and dignity. You will find this demonstrated in architecture, for instance in columns and spires; in the giant trees of the forest; in the lofty mountains; or, what is more suggestive of grandeur than the large massive clouds to be seen at times towering one upon the other in the far west, bathed in the resplendent light of the departing sun? To bring this practically home, examine some of your photographs, and you will find that tall figures, other things being equal, have the most dignity. It is well to remember this when posing, for much can be done in assisting this effect by properly arranging the flowing lines of the dress, or by the introduction of some object to carry out and extend the line.

46. HORIZONTAL LINES tend to repose, and again the reader is asked to turn to nature for proof of this. Look at a fair-weather sky; if there are

45. For the choice of line, no specific rule can be given. The artist must be guided by the general laws of harmony, which require that the line should be in keeping with the subject. It may be the parabola, the serpentine, or the angle. Harmony also requires that the character chosen should pervade every part of the work.—M. A. DWIGHT.

46. Allston says: "By a line in composition is meant something very different from the geometrical definition." Originally, it was, no doubt, used as a metaphor; but the needs of art have long since converted this, and many other words of like application (as tone, etc.), into technical terms. Line, thus, signifies the course, or medium, through which the eye is led from one part of the picture to another. The indication of this course is various and multiform, appertaining equally to shape, to color, and to light and dark; in a word, to whatever attracts and keeps the eye in motion. For the regulation of these lines there is no rule absolute, except that they vary and unite; nor is the last strictly necessary, it being sufficient,

clouds, you will find them generally with a horizontal base: and even if they are large cumulous clouds, you will find an abundance of horizontal lines to give the effect of repose and rest. What is more peaceful in effect than a large tract of level country? The eye is carried by line after line to the distant horizon. Again, the sea, when in repose, is calm; and calm, level water is always expressive of peace and quiet; and, when travelling amidst mountain scenery, as has been already stated, suggestive of grandeur, what is more peaceful or symbolic of repose than the clear, placid lake at the mountain base, unless it is the horizontal streak of cloud which is so often to be found resting on the rough breast of some peak?

47. Wavy or Tortuous Lines indicate motion or unrest. Proof of this we find, if we look at the sea driven about and tossed with the wind, the mountain torrent, clouds in motion, a flag fluttering in the breeze, the crowded, bustling thoroughfare. And, supposing many readers to possess, or to have access to, some photographs of the great rapids of Niagara, if they are studied, they will bear testimony to the truth of this remark. These lines become of great service in standing figures of ladies where there is much dress to be disposed of, and also where drapery must be introduced. They break the monotony of straight or unbended lines, and are the most beautiful of all when permitted in proper place.

48. Having demonstrated what is meant by composition, a few of its leading forms will now be explained and illustrated: and while this is done, it is not to be supposed that it is desirable to compel, as it were,

if they so terminate, that the transition from one to another is made naturally, and without effort by the imagination, nor can any laws be laid down as to their peculiar character; this must depend on the nature of the subject.—M. A. Dwight.

47. No established rules for posing *can* be given. It is an art in itself, and can only be acquired by diligent study, careful observation, and profound thought. See that the pose is natural; no matter how graceful and easy it may be, if it is such a one as no human being takes naturally, it is simply absurd.—Frank Jewell.

48. A beautiful combination in nature will often appear to evade every rule by her being perfect in every mode of examination. All her varieties emanate from a straight line and a curve. A judicious arrangement of objects possessing these various forms gives the strongest natural appearance to a picture; nor ought the artist to leave out rashly what he may conceive to be void of beauty. In coloring, harsh tints are admitted to produce harmony in the other colors; and the most picturesque arrangements often depend on the presence of what might otherwise be considered ugly forms.

As I have made use of the terms "beautiful and agreeable arrangements," it is proper to give an explanation of the sense in which they are applied. By a beautiful arrangement I mean a proper adaptation of those principles that arrest a common observer, and give a

every picture produced to slavishly conform to any precise rule. But rather, by directing attention to the modes of construction adopted by those whose works evince a full acquaintance with the principles of composition, it is hoped to cultivate the mind and educate the eye of the photographer. He may then, while composing, be as sensitive to an ungraceful line or incongruous accessory as is the skilled musician to a false note.

Fig. 12.

49. Angular Composition is the form to be considered first. In compositions following this form, the greater part of the lines are directed diagonally, as in the caricature of "The Flight of Æneas," from a Campanian mural painting. True, we have not much of *art* here, but we have the strict following of the principle in question. With a rule, enclose the drawing in a square, and then draw lines from the right upper corner to the left lower, and it will be seen how true this is. And yet the lines are not so severely unbending as you would draw them, though directed diagonally, and strictly "in form."

pleasurable sensation, which, to a cultivated mind, increases (not diminishes) by the investigation of the cause which produces it. For example, a beautiful appearance in nature affects the savage and the philosopher from their sensations merely as men; but a painter, whose life is spent in a constant competition with nature in producing the same effects, receives a tenfold gratification in following her through those assemblages which to the world are, as it were, "a fountain sealed and a book shut up." Hence, in art, a beautiful arrangement must be a selection of those forms, lights, and colors that produce a similar result; and the taste of an artist is shown in heightening their effect by the absence of those circumstances which are found by experience to produce the contrary. Did an investigation of the means pursued by the great masters tend to abridge an artist's pleasurable sensations, instead of being the most favored, he would be rendered the most miserable of beings; but the opposite is the case, as by such means he is taught an *alphabet* that enables him to understand the language of nature.—John Burnet.

49. The student will do well to observe attitudes assumed in every-day life, and adapt them to his art. When he sees a beautiful attitude, let him speculate upon the cause of its being beautiful, and he will find that it depends for its effect on its consistency with the rules of composition; and although these rules will not supply him with imagination sufficient to enable him to perpetually invent new arrangements, he will find they aid him very materially in giving expression to his inventions, and will prevent him being extravagant or exaggerated in his arrangements of the form. He should also store his mind with incidents

50. As a further example, a picture is taken from a more modern source, "Mignard's Daughter," painted in the seventeenth century, by Pierre Mignard. Now see how it will instruct you to observe how beautifully joined the lines are here. Every one is full of grace, uniting in the most winning manner, one part of the picture with the other, and every curve or bend having a corresponding curve or bend in an opposite direction, thus maintaining a perfect balance. Accessories and lighting, too, are all made to do their part in the work. This is a study well worth the careful attention of the portrait photographer, for, as a whole, it is a composition which would not be difficult of his imitation, with a living model, in his own studio. For this reason it has been chosen. It is full of suggestion and beauty, too.

FIG. 13.

suitable to his sitters, and he may then, perhaps, be able to give less occupation to the eternal book we see in the hands of photographées almost as often as a roll of paper is represented in the statues of statesmen.—H. P. ROBINSON.

50. It is universally allowed that Raphael excelled all other painters in a graceful arrangement of drapery, and a natural disposition of folds. By studying the principles of the ancients, he learned to consider the figure as the principal part, and that drapery should be considered as an accessory. That it is intended to cover and not to conceal. That it is employed not from caprice, but from necessity. Consequently, the dress should not be so narrow as to constrain the members, nor so ample as to conceal them, but suitably adapted to the size and attitude of the figure represented. His ample draperies had no useless folds, and were bent at the articulations. The form of the figure indicated the form of the folds, and on the great muscles he formed great masses. When any limb was foreshortened in the drawing, he covered it with as many folds as if it were extended, but crowded them in proportion to the foreshortening. By the folds of his draperies, it is easy to determine the attitude of the figure previous to the one in which it appears. For example: whether the arm were extended or reposing immediately before the action in which it is represented. This was an expression he carefully studied on all occasions. When the drapery was to cover the leg or the arm but partially, he made it cut the member obliquely. His folds were of a triangular form. The reason for this is found in nature; for all drapery, after being extended and then falling again under the pressure of the atmosphere, is naturally formed into triangles. His whole practice demonstrates the theory that the movements of the figure cause the peculiar form and position of the folds exhibited in the drapery that covers it.—M. A. DWIGHT.

51. Many artists, when composing on this principle, especially in landscape pieces, so arrange the cloud lines that they form a balance by running counter to the lines in the composition proper, as shown in this very beautiful example, "The Harvest Wagon," by Philipp Wouwerman, which hangs in the Leuchtenberg Gallery. We may almost see the forms of the figures repeated in outline in the clouds, by reversing the picture. The story is well told, and the artist was true to the principles of his art.

Fig. 14.

52. Something more directly in the line of photographic portraiture will be found in the picture of "Master Lambton," by Sir Thomas Lawrence, that wonderfully successful portrait painter whose works are always worthy of study. Many painters,

51. The sky requires careful study and arrangement to produce the right effect. The lights formed by the clouds must be arranged in such a manner as not to lose their force. Small clouds seldom have a good effect, and betray a feebleness of manner in the artist, excepting when they are so arranged as to form a single object. Clouds give expression to the character of the scene represented; for instance, as they gather for an approaching storm, or break away to make an opening for the welcome sunbeam, after having deluged the earth with water. And again, they may express the beautiful repose of a quiet summer afternoon.—M. A. Dwight.

52. The first condition of a good attitude is, that it should be in harmony with the age, stature, habits, and manners of the individual; secondly, that it should express the greatest beauty of which the model is susceptible. As we have already stated, the perfect knowledge of the individual is the sole guide for a suitable choice of the position; the defect to be most guarded against is that caused by borrowed and studied attitudes. The photographer must, therefore, observe attentively, reflecting on his subject, and try, by all possible means, to engage the attention of his model, and to endeavor to make him cease to think of the portrait for which he is come, seizing and noting the natural movements which are visible during these short intervals of forgetfulness.—M. Disderi.

in adopting the angular form of composition, have so arranged the leading lines and points in their pictures as to form a diamond, and an examination will serve to show they have done so to good purpose, as groups so arranged have a very pleasing effect upon the eye. The "Master Lambton" requires but little filling in of a line to make it of diamond form. Turn it sideways and we have a pyramidal form, of which method what follows will tell more particularly.

Fig. 15.

53. The Pyramidal Form of Composition, in many respects, closely resembles the angular, the only difference being, that although the angular may, and often does, contain within itself many pyramidal parts, yet the angular form predominates, and *vice versa*, in pyramidal. And while there may be much in the composition or arrangement that would be apt to have it classed as angular, yet the impression given, when viewed as a whole, or when the leading lines are analyzed, will be that it partakes most of the form ot a pyramid. This form is particularly adapted to groups.

54. It is, therefore, thought best to mark the distinction, as the pyramidal will be found to be the most generally useful in composing single

53. Now what we want, good fellows, is less reality and more idealism; less completeness and more suggestions; less of the actual and more inference in our work. This intensity of truthfulness amounts to deformity and disfigurement, and is a dangerous fault because of its *negative* merit. It is a rare requisite, this thing we lack. A coy, shapeless, almost indescribable quality; better told in what it does *not* consist than in what it does. An ethereal, atmospheric quality—fleeting and full of feeling; a quality not so much of brains as soul, and yet plainly with brains to back it.

To be literal and practical in this matter submit to the rules, although seemingly inconsistent to apply rules to idealizing photography.—J. H. Kent.

54. Our chemical effects may be faultless, our pictures ever so sharp, but without proper *pose*, *lighting*, and *expression*, our resulting pictures will only be stiff, hard, soulless images. Without this soul and lifelike animation that proper care can obtain, and may always be found in every face (be it ever so dull), we fall far short of what our art is capable of producing, and the good to which we all should aim, and to which we all can reach, if we only apply the means placed before us.—Alexander Hesler.

EXAMPLES OF ANGULAR COMPOSITION, PHOTO-ENGRAVED FROM NATURE.

figures, particularly ladies—in fact, three-fourths of the portraits produced by photography will be found, on examination, to partake of this form. It is hoped that its study will lead to perhaps a better appreciation of where, and in what manner, to introduce complementary lines. In arranging groups of figures, a regard to and application of this form of composition will often be found useful. Remember, then, the very great importance there is for having a graceful or pleasantly flowing line, either internally or in that which constitutes the leading outline. This will apply to all the leading forms of composition.

55. It is not intended to advocate anything like a close approximation in any composition to the lines forming a pyramid, but rather as in listening to any well-known air with variations we have no difficulty in tracing the air itself running through them while the piece is being performed, so in the necessarily varied lines of a drawing or photograph, if there is art or design in its construction, the educated eye can discover the method of composition, and thus more readily enter into and understand the motive or intention of the artist. From the author's collection of photographic portraits, six examples of the angular and six of the pyramidal form of composition have been selected and photo-engraved, as proofs of how these principles may be carried daily into practice.

56. To explain this point more fully, an example is given, "The Expul-

55. This art of composition is a part of photography, just as it is of music or architecture, or of any other of the fine arts. It enters into the construction of the simplest picture. One view of a face, unless it is well chosen, is often of little value as a likeness. Suppose we catch a swift glimpse of a stranger's profile; it is very little we know of his face and character until we have seen more of him. But a momentary glimpse—one look of the face—is all that a photograph likeness gives us. The moment you begin to arrange your sitter to get the most of him before the camera, you are studying the art of composition. Every change of position, every object you introduce, every bit of light and shade augments or diminishes the value of the picture. It must conform to the ancient law of variety and unity, and the more variety introduced the harder the problem of unity becomes. It seems reasonable that the study of the masters in pictorial and plastic art would be of advantage in photography as it is in the other arts. I need only suggest among the many the names of Turner and Rembrandt as great masters of composition. Tintoretto is another who has hardly an equal; but I cannot understand why his work in any form is almost inaccessible to us.—Charles Akers.

56. Make it a constant practice, before removing the cap from the lens, to first give a rapid glance at the sitter, to see whether the outline of the figure composes well, that the light and shade are massive and round, and that there appears some indication of the expression you desire on the face of the sitter. If there is a lack of either of these qualities, do not waste your plate until you have got them before your lens.—H. P. Robinson.

sion of Hagar," by G. Flink, with the pyramidal lines running through it. An examination will show the play and variety of the outlines. While a graceful outline is obtained, do not overlook, but be very careful in arranging and composing, the internal lines of the composition.

Fig. 16.

57. Nothing should be considered too trivial; every part should receive a due amount of care. At times, simply the fold of a dress, or the proper position of an otherwise insignificant accessory, will put the whole picture in harmony.

Ruskin, in speaking of arrangement in the smallest detail, takes notice of some leafage in the foreground of one of Turner's paintings, and says: "Unless every leaf and every visible form or subject, however small, forms a part of some harmony, it has no business in the picture. It is a necessary connection of all the forms and colors, down to the last touch, which constitutes great or inventive work, separated from all common work by an impassable gulf."

58. Also note, that whether it is a single figure or group that is being arranged, it is of great importance to have *variety* in the flow of the lead-

57. In taking the portrait of a sitter, I generally decide at a glance the best point of view of the face and the kind of lighting required to suit, securing a graceful pose, and quietly making all the arrangements without hurry and bustle, keeping up a quiet conversation till the critical moment of exposing the plate. To secure a happy expression on the features of our sitters, so that their photographic counterpart shall represent *animate* instead of *inanimate* beings, is the most difficult part of the portraitist's art. In this, more than any other point, is seen the difference between the works of an art-photographer and those of the merely mechanical one.

In posing avoid straight lines and right angles in the figure; and try to secure flowing line, but not to overdo it, as I have seen posing run mad of late—sitters taken in the most extraordinary attitudes. I know a photographer who, on seeing a fine posed portrait by me or any of his friends, will rush home with it and take all his sitters for a month in that pose, until a fresh idea crops up from another friend, and then, but not till then, does he give his sitters a change. This I think rather too bad, and I often tell him to manufacture his own. It is much better to invent one's own style of portraiture than to be continually copying another photographer's work.—R. Slingsby.

58. Variety in our work has not been sufficiently insisted on. We go on year by year in the same old grooves; we make the same old cartes and vignettes; the same front elevations of houses and public buildings. Not that we are not fond of variety; on the contrary, we

ing outlines. Take, for example, a single figure, and suppose it to be photographed, front figure, front face. You might draw a line down the centre and find each of the halves exactly alike, symmetrical, if you choose, from being alike, but certainly not graceful. Turn either the head or the figure, however slightly, giving a trifling bend or inclination to the head, and you need not to be furnished with a drawing to prove which gives the best effect.

59. Likewise with a group, do not have each figure placed at equal distances, nor all looking in the same direction, unless, indeed, to tell the story, and even then *variety* can be obtained by varying the pose of the heads. But, as a good illustration will enforce the idea much better than anything that can be written, carefully study the engraving, for example, of "Family Devotion," by Jean Baptiste Greuze. A better one could not be given, both as to the flow of the outlines and the various inclinations of the heads. Or a similar study may be found in Wilkie's "Blind Fiddler." The

Fig. 17.

like it well enough when we can get it cheap, without any trouble, ready made. If one, with a little more ingenuity or imagination than his fellows, traces out a new tract, he is first allowed to test its fruitfulness, and if it is found successful, there is a rush of all his fellows to scramble for the nuggets on his claim. Why don't photographers prospect for themselves? They are pretty sure to find some artistic or technical mine or other that will pan out well, and bring them fame or fortune, perhaps both.—H. P. Robinson.

59. A great improvement can be made in posing (at least in some cases); some photographers, or would-be photographers, treat their subjects in a manner which is perfectly horrible. For instance, even in a bust picture, the head is turned to one side about a three-quarter view, just enough for the tip of the nose to come even with the outline of the face, thereby giving an unnatural appearance to most faces; and, again, in Rembrandt lighting, posing the head so that the ear of the sitter will on the right side be just visible, or a part of it,

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latter will be remembered by the readers of the *Philadelphia Photographer* for 1879, page 331, and it may be also seen, with remarks, on page 65 of Robinson's admirable *Pictorial Effect in Photography.* No one at the present day can say he has no opportunity for studying art, for by the cheapness of the press it is brought within the reach of the humblest, in magazine and book illustration. Our news-stands are full of studies.

60. When you have practised this habit for awhile, you will find yourself measuring every picture you see by the rules of art; and the study of art will become an unending pleasure to you. As another excellent example of this form of composition, an engraving is given here of "The Empty Jug," by A. Von Ostade. Take these figures, individually or collectively, and you will find the pyramidal lines carefully observed by the artist. How capitally the story is told, too, not only by the attitude, but by the expression of the members of this disappointed and curious trio. It is a picture, too, not hard to repeat by means of photography, for such groups are no longer beyond the capabilities of our wonderful art.

Fig. 18.

just enough of it that when you look at the picture you will not be able to tell whether it is an ear or a wart, or what it is. Now I claim that such small things should not be overlooked, no matter how good otherwise the negative may be. It will pay to make it over, for your customer will not be satisfied with such work; and how could you expect him to? The sooner photographers learn those lessons which go to make up in a large degree the successful photographer, the better it will be for them, and the day is coming when those cheap Johns, who care nothing about good artistic positions, well-lighted and manipulated effects, must of a necessity take a back seat. Our citizens are learning how to appreciate good work, therefore we must be alive to our own interest. Should you complain that your customers are leaving you, and are patronizing the larger cities, just take a good square look at yourself and your work, and see if you are not behind the times.—F. M. Wells.

60. Some photographers pay too much attention to the dress of their customers, forgetting they have a face; this far too common habit must be changed by those who would make a reputation with the general public.

In the now fashionable large head on the card size, always draw the focus *well forward;* if not, the back hair will be too sharp, the whole effect inartistic, the picture lacking roundness; also, for the reason that, if too far back, the features will be out of proportion, the

61. Permit another example—"A Surgical Operation," by Adrian Brouwer, from the Stadel Gallery at Frankfort. Here, too, it will be observed how the artist has been constrained by the form of composition in question. The diagonal form is also well represented in it, amid the internal lines, and the whole is in most excellent harmony. When the study of light is undertaken, this excellent picture may be again referred to with profit. It is a wonder in that line, showing the ability of the master in a high degree. The interest in the picture is all derived from circumstances *actually present*, truly expressed on the canvas. The girl who

FIG. 19.

" . . . Never told her love,
But let concealment, like a worm i' the bud,
Feed on her damask cheek," etc.,

would have been much more difficult to represent in a picture.

nose, mouth, and chin will be distorted and enlarged, thus the drawing will be faulty.—CHARLES WAGER HULL.

It will be readily seen that the study of costume is of great importance to the artist, yet he must be careful not to go too much into detail in regard to time, place, etc. The promise of art allows him a certain latitude, of which he must avail himself if he would make a pleasing picture; on the other hand, he must be careful not to err in taking too much, between the two extremes he will be guided by his taste and judgment; rejecting what is unnecessary to truth, and admitting all appropriate beauties and characteristics.

There is, perhaps, no department of art where taste and propriety are so requisite, yet many instances occur among the works of the great masters where they apparently attached no importance to the costume of a picture. These the student must not take as a guide. For instance, a picture of Eve, having her hair tied with blue ribbons; or the Israelites, represented with muskets, as in Tintoretto's picture of "The Falling of Manna."—M. A. DWIGHT.

61. In the posing of the model, it should be our first care to see that each and every part of the figure is *natural*, and that the muscles of the body, and especially the neck, are relaxed and easy. Avoid sharp angles and straight lines, and, as a general thing, the head and body should turn in different directions, and a gentle curve of the neck will frequently give ease to the whole position.—FRANK JEWELL.

62. In the Dresden Gallery is an admirable painting of the studio of Adrian Van Ostade, whose "Empty Jug" you have just looked upon.

Fig. 20.

It is so wonderfully full of suggestion that it is given here as a study, more especially in the arrangement of accessories. Look into it well, and see how wondrously the artist has been influenced by the form of composition now under contemplation. It is full of pyramids and diagonals, and yet how beautifully harmonious it is in every particular, and how true to nature.

63. Should you desire to further exercise in the study of this style of composition, take prints from your own negatives and study them, taking note of where you have erred and where you have preserved the proper form. Draw pyramidal lines if you will, as in the figure above, and then invent improvements agreeable to the subject and the accessories you may possess.

Fig. 21.

As has been said, it is not intended that a rigid following should always be observed of the form of composition chosen by you for your picture in hand. Only let it *influence* you, as the sun and the clear air do when you walk. How even the ancients worked pyramidally is shown by "The Goat and Faun," taken from a mural painting at Herculaneum. These illustrations par-

63. If you would have success, you must work for it. Look at the example of Mr. W. Kurtz, the artist-photographer. Let us look into the cause of his great success. In the first place, he is the very hardest and most faithful worker in the whole establishment. Every pose is made either by him personally or under his immediate supervision; the lighting especially claiming his entire attention. I sometimes think he knows *exactly* what he is about. The features of every individual undergo close scrutiny, and the most is made of his or her points. Nothing is "all right" until he has thoroughly examined it, and every negative taken is carefully studied by him before *he* says it is "all right." Again, he examines every "proof" before it is shown to the sitter, and such as do not come up to the mark of "all right" are destroyed.—Elbert Anderson.

EXAMPLES OF PYRAMIDAL COMPOSITION, PHOTO-ENGRAVED FROM NATURE.

take rather of the grotesque, sometimes, but such are believed to be most easily remembered. They are all impressive works of art.

64. Circular Composition.—Having now endeavored to explain and illustrate the angular and pyramidal forms of composition, it is desired to draw your attention to the circular form. It will be found the style of composition to some extent applicable to photography—particularly in grouping. Before attending to the examples given below, note, for your guidance, a few things which it is necessary to attend to when grouping.

65. The story must be well told; that is, one figure must be so linked to the other that the spectator has little or no difficulty in discerning the purpose or designs of the photographer; see that the parts assigned to each figure be appropriate and natural; that the general outline be graceful and pleasant to look on; that the grouping affords an opportunity for a judicious arrangement of light and shade; and not only should the lines of the group so run that the eye is led to the principal figure or figures composing it, but the principal focus of light should also be so managed as to assist in doing this (see Fig. 19). Use all the appliances at your disposal to reach the highest point of excellence; and, to those who have not yet tried a camera with a swing-back, be it said, if you can afford it, by all means get one, and see that the arrangement is such as to swing both horizontally and perpendicularly.

66. To succeed in photographing groups, the photographer must not only possess quickness of perception, but promptness in decision, and

65. The art of posing (for it is an art) should be studied by photographers as carefully as any other part of their business, as in this direction lie important aids to success. Gentlemen, look into and study this subject. Discard the methods so long in use which have led to the saying, "As stiff as a photograph." It is too horrible for you to go on putting people into stocks and pillories, and then making pictures of them in their torture. What will our grandchildren say when they see the cast-iron appearance you give to your subjects; and while you are about it, carry your studies still further into the realms of grouping. You know that composition pictures are always attractive, but when made by a single exposure the imperfections are so prominent that no one is satisfied. Now, to try this plan. When the skies are leaden and the streets sloppy, and no one thinks of going to your rooms, then get up your designs, remembering, above all things, the necessity of correct perspective; call in a few friends, one by one, as you have leisure, put them in position, and get up your specimen. You will find that the consciousness of being in a position that means something will take away the statue expression every one assumes when a camera is pointed at them.—W. D. Gatchel.

66. In making the sitting, study your subject well in all the different views; make up your mind which is best, or will harmonize best with your sitter's taste; stick to that position until you get a satisfactory negative. However, should you have several negatives, and are

that in a very marked degree, for, while these qualities are required in the posing and arranging of single figures, the difficulties to be overcome are tenfold when you have to compose and arrange a group, even of three or four figures, for it must be remembered that not many minutes often intervene between the conception and the completion of the work. To succeed, then, all the powers of the mind and the eye must be put forth, and that with an energy that many do not understand. The painter, in composing, has more leisure to arrange, complete, and perfect his ideas; nor is he so tied down as to depth of focus, etc.

67. But do not entertain the idea, that all the advantages are on his side. The rapidity of production which the camera affords, if properly used, is a very powerful means of educating—the work, good or bad, is at once before us to study—and, by studying, we can see many of our faults, and discern points of excellence, which the careful photographer stores for future use; and many of the mechanical difficulties, when earnestly grappled with, give way to our will. It is hoped that not a few of those who have given this subject their careful study, will find help to a quick perception of what is good or bad, and be enabled to promptly decide on what to accept or reject.

68. Some hastily reject all rules, and consider them only a hindrance to their progress in art, because men have arisen, from time to time, whose works were formed by no rule, yet became a model and a rule to other men. Still, as Professor Sedgewick has remarked, "Few, however,

in doubt as to which is best, prove them all, and then make the selection yourself, and show only one. If, however, your customer is not pleased, you can then bring forward the others, if you think there is anything in them to remedy the difficulty.—F. B. CLENCH.

67. Make your sitter at ease with himself, draw out his finer feelings, and, if possible, bring all that is good and noble within him to the surface, and being prepared, your light in harmony, watch and catch the right expression. As a photographer you may be ashamed of the resulting picture, but you have reflected from that face the soul and beauty within.—ALEXANDER HESLER.

68. Now, no doubt, it is well to be humble. The first test of a great man is his humility; but I do not mean, by humility, doubt of his own power, or hesitation in speaking of his opinions, but a right understanding of the relation between what *he* can do and say and the rest of the world's sayings and doings. All great men not only know their business, but usually know that they know it; and are not only right in their main opinions, but they usually know that they are right in them; *only they* do not think much of themselves on that account. Arnolfi knows that he can build a good dome at Florence; Albert Durer writes calmly to one who finds fault with his work, "It cannot be better done;" Sir Isaac Newton knows that he has worked out a problem or two that would have puzzled any one

among us are permitted to show this high excellence; ordinary minds must be content to learn by rules, and every good system must have reference to the many and not the few." We have undoubted authority in the example of the great Raphael for being humble and apt to learn.

69. The accompanying wood-cut is a copy of one of Raphael's drawings, at the margin of which is the following memorandum: "It is to be observed that the first thing to be considered in an historical composition, is where the point (that is the spectator's eye) is to be placed, whether in the middle of the work or on one side, and so to determine its situation that the important figures be distinctly visible, not concealed by others; and then begin the design. It is my opinion, confirmed by the practice of the most skilful men, that the mode explained by a drawing in the margin is generally fittest; viz., by contriving that those figures which are nearest to the point should present their back, those furthest removed, their sides, and so on in perspective; as if a circle were drawn and figures were arranged around it, so should an historical composition."

FIG. 22.

70. The student is again referred to the engravings, which are now so

else; only they do not expect their fellow-men to fall down and worship them. They have a curious under-sense of powerlessness, feeling that the greatness is not *in* them, but *through* them; that they could not do or be anything else than God made them, and they see something divine and God-made in every other man they meet, and are endlessly, foolishly, and incredibly merciful.—JOHN RUSKIN.

69. Figures should be more or less varied in attitude, because an exact repetition of lines produces formality. The manner and extent of variation must be decided by the subject. They must also vary in regard to prominence. The artist who represents all the figures introduced in his picture as holding the same rank, making each one equally prominent, understands nothing of the principles of nature or the laws of art. The same artist will, with great labor, bring forward on his canvas the most insignificant objects; for trivial minds ever value trivial things.—M. A. DWIGHT.

70. Experience tells me the best way to "elevate our art" is for each one to do the *very best work* he can under all circumstances, and *let our customers know something of the work and expense needed to attain the end desired;* and the better they understand the intricacies

easily accessible, for further studies in this form of composition. It is not needful to multiply them here, since enough has already been said to give you a clear insight into the matter, with the hope, too, that you are fully interested enough to pursue it and profit by it largely. The circular form in its internal lines also requires the use of the angular and pyramidal in the arrangement of its parts. They always come into play—are always useful in the great work of elevating our art.

71. Much has been written, and very properly, too, on the best method of constructing the glass-house or photographic atelier, and doubtless the papers which have appeared on the subject have been of good service to many. But it is believed the subject about to be treated is one of graver importance; the former being the means to the end, while the present topic is the end or purpose itself, viz., *chiaro-oscuro*, or light and shade; and it is affirmed that if the recognized principles of light and shade, as applied in art, were more fully understood by photographers, there would be much less information required on how to construct a light, for knowing how to use it would solve many a difficulty.

72. Let the light be ever so perfectly arranged, it must, of neces-

of the art the more it will be appreciated; and a picture that is *well paid* for is treasured far more, and its good qualities more apparent, than when a few cents will purchase a peck or less. People always appreciate anything according to its cost, no matter what it is.—Mrs. E. N. Lockwood.

71. On the proper management of his light depends the chief success of the photographer. This is the most difficult part of the art to learn, because no absolute rules or exact formulæ can be laid down. It is as well it should be so, as each one who studies to light his pictures artistically is certain to receive his immediate reward by the superior results he will produce. Mere mechanical skill is easily acquired; but artistic excellence is only secured by a study of the conditions of light and shade.

The first thing a photographer has to learn on this subject is that no reliance whatever is to be placed on lens, camera, and chemicals. These, valuable enough in their places, can teach him nothing here. He must go to the fountain-head—*light itself.* Whatever light falls on, it enlightens, whitens. White is the representative of light; black that of darkness. If an object be wished to be represented white, it must be placed in the light; if black, the light must be excluded from it; if partially white and partially black, the light must be so allowed to fall on it that while the parts that are to be represented white must be illuminated, the others that are to be black must be protected from illumination. If the object is to be represented as being neither white nor black, but of some of the manifold gradations that separate the two, then the object must be so illuminated that just such amount of light and shade falls on it as represents the desired tint.—Jabez Hughes.

72. We are here reminded of a passage in Ruskin's *Modern Painters*, wherein he observes: "When the eye is quite uncultivated, it sees that a man is a man and a face is a face, but has no idea what shadows or light fall upon the form or features. Cultivate it to some degree

sity, vary with the season or the day, and still more, different models require different arrangements of light and shade. The subject is one deserving of deepest study, and those who know most will assuredly seek for a better acquaintance still with its subtle gradations.

73. This rendering of light within light and shadow within shadow, is peculiarly the province of photography, and there is no branch of the art that affords more scope for constant study.

74. The first thing to be noticed is, that when the sun is abroad in a landscape, the most characteristic feature to be observed is the decided, sharp, well-defined shadows, and in proportion as the objects are brilliantly lit, in like proportion will it be found that the shadows from them are deep and intense, and throughout the whole this last will be found to be observed in beautiful harmony, giving here brightness and precision, and there softness and delicacy, while in every direction an endless variety pervades, giving a charm indefinable by words. Also observe that in bright light and deep shadows the texture or detail is very limited, and that in nature neither bright light nor deep shade is to be found in large masses, but rather in points.

75. Where there is a large mass of light, either in sky or water, it will

of artistic power, and it will then see shadows distinctly, but only the more vigorous of them. Cultivate it still further, and it will see light within light and shadow within shadow, and will continually refuse to rest in what it had already discovered, that it may pursue what is more removed and subtle, until at last it comes to give its chief attention, and display its chief power on gradations, which, to an untrained faculty, are partly matters of indifference and partly imperceptible."

73. Now, what is lighting? You take a common watering-pot and remove the rose, and the stream of water goes out in a body. You put on the rose, and it causes the water to flow in little streams and scatters it. The same effect is produced on the light coming through the atmosphere; the atmosphere divides it, scatters it, diffuses it. We take a rod and strike the surface of water gently, and we drive the water in all directions, or according to the direction of the blow. So it is with light. It comes through a steep skylight, and it has to pass through the atmosphere to get to the subject, and the further it falls the more it is diffused.—A VOICE AT THE BUFFALO CONVENTION, 1873.

74. What is the philosophy of arranging a face under the light? What is the first thing to be done? The first thing is to admit as much diffused light over the whole face as you can: I will say pretty near as much as the eye will open and shut comfortably in, as will not affect the eye at all, or oblige you to close it. So that you can open the eye naturally: so that it shall not make you blink or want to look down. You want a light that will be diffused over the whole face and figure.—A. S. SOUTHWORTH.

75. A few questions: How do we recognize brilliancy in a photograph? Answer. By the *contrast* of light and shade. How do we recognize softness and delicacy in the same?

be found secondary to some brighter light, such as the bright edge of a dark cloud in the sky, the glancing wave on the sea, or the white sail of a boat; and, whatever may be the means used by nature, it will be found small in proportion to its brilliancy, and by its brilliancy it will give to these larger masses of light the effect of half-tone by comparison. Also notice that the highest lights and deepest darks are generally found in nature side by side—the dark giving brilliancy to the light, the light intensity to the dark. And again, we find when the sun is veiled and the light soft, and a half-tone pervades the face of nature, some sombre pine or overhanging rock will give the deepest shade—a small break in the sky, the highest light.

76. What can be more magnificent in light and shade than when, after rain, a stream of light shoots forth from the hidden sun and illumines, as if striving after effect, a selected spot of verdant field or wooded brake glistening with moisture and refulgent with color; or, when it selects the white sail of a distant vessel, or the beach of an opposite

Answer. By the *harmony* of the light and shade therein displayed. Let every one strive to attain a medium between the two, and the result will be satisfying to any one. You ask, how to set about it? Screen your skylight, and cut off by curtains all the superfluous light, leaving only enough to properly light the sitter; suitably contrast the dress and complexion with the right shade of background, and you will, by the proper strength of developer and correct timing, get all the intensity you desire. By hanging your plain, ordinary background on a pivot, and tilting it, you can have a different shade every time, suiting the most exacting sitter.—C. A. ZIMMERMAN.

76. The grand point, for those who have not paid sufficient attention to this most important of photographic questions, is to accustom the eye to constant watching—out of the studio as well as in it—for any unusual effect of light on the human face which may happen to be pleasing, and at once to analyze, as far as possible, the cause. I shall best further my object, before I speak of special studio arrangements, by describing two extremes of light, one favoring perfect relief, but with contrasts too strong for general photographic purposes, and the other—unfortunately too common amongst photographers—producing flatness and almost total absence of texture. By putting these two extremes side by side, I shall the more readily make clear what I desire to say. Those who have been in the studio of the sculptor for the first time, will have been struck by the wonderful delicacy and relief of any work in marble which may happen to be in hand. Should his curiosity lead him to watch the effect of the same kind of light on the human head and bust, he will be equally delighted with the novel effect of light and shade before him. He will notice a delicacy and texture quite unusual in ordinary lights, combined with the most perfect relief. The whole effect will be more striking and forcible; but after some time spent in close observation, he will find, that whilst the high-lights and those next approaching to them are wonderfully rendered, the deepest shadows and those allied to them are much too heavy for photographic purposes. The observer will feel less of this, however, if the subject examined should hap-

shore; or, as all have often seen, and wondered at its constant choice, the whitened walls of distant villages? In these two moods of nature, as it were, may be found the true foundation for all authentic principles in art. And the painter or photographer will select the mood most suited to his subject, and, like the writer of history or romance, he will use his highest powers, his brightest light, or deepest shadow, or both, to give full prominence to the leading point, judiciously obscuring others.

Fig. 23.

77. In the foregoing remarks, your attention has been drawn outside the studio, and to many this may seem of little practical value as regards their every-day work. But it is not so, for the same principle prevails both within and without. As a partial proof of this truth, witness this fine copy of "The Soldier and the Laughing Girl," by J. Van der Meer, of Delft, now in the Double Collection of Paris. It is a grand study in

pen to be a blonde dressed in light drapery. A little investigation will, therefore, show that the marble, being a semi-transparent substance, permits—indeed requires—this strong treatment, in order to produce the proper amount of relief, and that, in the case of the blonde with the drapery light in color, the shadows are softened by the reflections carried into them, and thus reducing their intensity. Every one must at some time or other have been struck with the wonderful effect of relief, combined with perfect transparency in the half-shadows, when a lady dressed in very light diaphanous material has chanced to be placed near an open window in a well-lit room. The effect is totally different if a swarthy, black-bearded man, in the mournful livery common to this age, should happen to be seen under precisely similar circumstances. In the latter case there are no reflections to help out the effect; hence the difference. I may say here, that the most perfect effects of lighting I have ever seen have been produced at a lofty side-window, the lower portion of which was covered with a semi-transparent material, a suitable system of reflectors being used to carry light into the deepest shadows to lessen the contrast.—Valentine Blanchard.

77. As to the study of light, I follow it intuitively. I find my models everywhere, in parlors, halls, churches, offices, shops, railway cars; wherever there are windows or gas-jets, and heads for the light to shine upon, there are my studies—sometimes more, sometimes less interesting, but studied all the same. Frequently in common conversation, or in the course of a business transaction, I give as much attention to lighting the head of my model as I do to the drift of his talk or the character of the business in hand. We may be introduced to a

chiaro-oscuro, a model for photographic imitation, and seems to have been made for this very purpose. It will bear the closest study.

78. It is also a fact, that in photographic portraiture it is not considered desirable to illuminate the sitter with direct sunlight, but, if we wish to produce the broad, open effect of daylight, with well defined and equally illuminated line, we must use a broad, open, well diffused light, so arranging the drapery of figure and accessories that we obtain enough of sharp and well-defined shadows to give the necessary pith and precision to the whole.

79. Careful attention to this point will give a much greater effect of brilliancy and light than any amount of over-intensifying. Again, if we wish to produce those effects which might be styled *a la Rembrandt*, we must use a more direct, concentrated light, and so arranging the figure or sitter that the light falls upon and fully illumines the portion of the figure we wish to give the greatest prominence, allowing the other parts, both of the form and outline, to be partially lost in shade. Do not misunderstand, blackness is not meant. By this means of lighting some

stranger, and while assuring him of the pleasure we have found in his acquaintance, and wondering if it will rain before night, we have discovered that his nose is a little out of true, and that a three-fourths face, away from the light, will suit him best.

In this study or pursuit much is to be gained. We learn to recognize the true from the false, the good from the bad. An education may be so acquired that would be obtained in no other way. We see and fix in the mind many peculiarities and effects of light that by accumulation become knowledge. There may be a lesson in the shadow thrown from a hitching-post, if we look for it, as much as there are "sermons in stones."

These hints and bits of observation, picked up in promiscuous ways and places, carried into the operating-room, give power to the possessor of them, and make him master of the situation. When we once get into this way of "trying on," we are not likely to abandon the habit.—J. F. RYDER.

78. Place the sitter so the light is diffused. I open the light for forty-five degrees usually. Why use that angle? Why not straight up over-head? The reason is, that I want to show the lines of the brow, the lines of the nostrils. I want to show the shadow falling off to this direction so as to give the shape of the nostrils. I do not want to show it as if I were standing under you and looking up into your nose. I do not want to throw a shadow on the noblest part of the human countenance.—A. S. SOUTHWORTH.

79. In these likenesses there is no striving for any transitory effect. No part of the face or head is put in deep shadow, all is clear and sunny. There is no flinching from hard work. Wherever shadow is used, the modelling is continued perfectly throughout the whole. In the best faces of Titian no shadow is apparent, yet there is no flatness; they are full and round, like nature herself. And some of the best heads of Rembrandt, fond as he was of shadow tricks, are painted in this broad and sunny way. These great artists studied to give the sum of human life—not five minutes of it.—CHARLES AKERS.

very grand effects are produced. Many have supposed, however, that this style is conventional and unreal. Such is not the case, for the same effect may be seen in any apartment which is but partially illuminated, whether by artificial means, or by the opening by which the daylight enters being small in proportion to the size of the apartment. Both ways are correct in principle and equally good if suited to the subject; the former will be found most serviceable for general use, and may be considered as nature's sunshine, while the latter may be appreciated as we do nature in her grander moods, as in the coming storm or the play of the forked lightning.

80. If you are a landscape photographer, having selected your point, the proper time of day to give the best effect of light and shade, look closely into nature, mentally note down its most observable peculiarities, and when you have completed your negative and printed from it, compare notes, those mentally taken and those in the photograph before you; find out what of nature's beauty you have caught, and where you have fallen short. Do not be content with the fact that you have obtained a passable, nay, a good picture, for by such close observation you will acquire a better knowledge of the laws of nature, discover the weak and the strong points of photography, and thus be able, as experience ripens and increases, to assist the former and make good use of the latter.

81. If you are a portrait photographer, do not be content with having your light built and arranged on the same principle as an adored model

80. Among some photographers the impression seems to prevail that the reflection of the image upon the object-glass is to be depended upon exclusively in judging of the proper lighting. Let me state that these glasses are great flatterers and deceivers, as negatives frequently testify when left to them. Should you be using a number of instruments, the chances are the color of each glass is different, which makes them still less reliable as guides. Trust your eyes in arranging your lights, and when once accustomed to the manipulations in that particular, you will prove yourself competent in your position, and have secured much that is all-important to success in your profession.—A. Simson.

81. There is no part of the human face that should be represented in a portrait as white. There may and must be parts that are lighter, but these parts should never be white. The whole face should be shaded, while the most prominent points, such as the nose, brows, chin, etc., should be touched with light. The retiring parts of the face must be shaded more and more as they retire, but care must be taken that they become not too dark and lose definition. As a general thing, too much light is used (I suppose for the purpose of shortening the exposure); but this is an erroneous idea. The light should come from one direction, and more from one side than the other.

There are three kinds or qualities of light used in portrait photography, viz., diffused, direct, and reflected. Of these three, diffused light bears the most important part, and is

of yours, who produces pictures worthy of the art; and having found out that on a certain day and on a certain spot, under such a light, you have produced a photograph as good or better than your neighbor, that from henceforth that is *the* spot, and that on that spot every future sitter must be placed, irrespective of age, form, or feature, or color of dress. No; on the contrary, carefully select the best situation and arrange the lighting, having a keen, quick eye to its adaptability to bring out the points, losing the others in the shade, and, while the general effect of the whole is seen to, do not lose sight of the tender variety of lights within lights and shade within shade; and when you have given attention to all this, in the posing and arranging, observe that the effects thus far sought for are not lost by a wrong exposure, or by under- or over-developing. Be fully assured that if you do not habitually accustom yourself to look for these finer and more subtle gradations of light and shade, and use your highest powers to secure them, your works will neither be a credit to yourself nor to the art.

82. Having now tried to explain the value of a knowledge of *chiaro-oscuro*, or light and shade, to the photographer, and to urge the importance of the study thereof, it is in order to proceed to investigate this principle in its various situations. But, before doing so, please to notice a few of the more palpable and self-evident combinations. Do not neglect these important points. They may be divided into five parts, viz.: *light*, *half-light*, *middle-tint*, *half-dark*, and *dark*. These are the five grand points of the subject now to be studied. In beginning any work we should know which one we desire to secure, and work and arrange accord-

the one used in the largest quantity; reflected light, the one used least. A diffusion of light, however, over the whole face would render it flat, and with a lack of vigor. Direct light now comes to our assistance, and by a judicious use in small quantity lights up the prominent parts of the face, rendering the whole image bold and vigorous; and it is sometimes the case that a little reflected light may be used with advantage, but should be used judiciously. —Frank Jewell.

82. My reading and my observation amount to simply this: Have a room where you can *control* your light thoroughly and perfectly. Have a room where you can give as much diffused light on the face, without making it one particle more on one side than on the other than the eye can bear comfortably; then grade it. Then open your sky-light just as you want it, to give the right light on the nose and forehead, giving the shadows as they ought to come, and you have your light right for the subject; and for the different lights, change your subject around the room, and if the nose happens to be a short one, you have got to manage it, or if it is very long, and if there are wrinkles your diffused light lights them up.—A. S. Southworth.

ingly. After the work is done it should then be compared with what it was *intended* to produce, and see *how* far success has been attained.

83. When the picture is composed of light and half-light chiefly, the darks will have more force and point, but the picture will look feeble and weak, to use a common term. When it is composed mainly of dark and half-dark, the lights will be more brilliant, but they will be apt to look spotty for want of half-light to spread and connect them, and the picture will be in danger of becoming black and heavy; and when the picture is composed chiefly of the middle-tint, the dark and light portions would have a more equal chance of coming into notice, but the general effect is in danger of being insipid and common. This will be more fully understood if the operator will take examples of his own or other work, lighted differently, and carefully study the effects mentioned, so far as the pictures will permit.

84. The results which light and shade may produce are very many, but the principal ones generally sought for are *relief*, *harmony*, and *breadth.* By the first we are enabled, so far as the camera, lens, etc., will allow, to give the distinctness and solidity of nature, *i. e.*, so near as we can, a *stereoscopic* effect to our pictures. The second is the result of a union and consent of one part with another; and the third, a general breadth, gives the idea of *extent* and *magnitude.* Now, these three properties should employ the careful and most attentive examination of every one who de-

83. Perhaps, among beginners, there is no more common error than the employment of too much light. The natural instinct of the artistically uneducated mind seems to be to surround the sitter with light, to throw it in on all sides, and as much on one side of the face as on the other. How grave a mistake this is.—W. J. Baker.

84. It will be found that whilst one operator rigidly adheres to the plan of contrasting the lighted side of the figure against the dark part of ground, another will as uniformly practise the reverse, *i. e.*, placing the illuminated side of a face against the light side of the ground, and the shadow side against the darker. Pictures in these two styles will be found most numerous. A third party will, for all kinds of subjects, invariably use the darkest side uppermost, and a fourth the lightest. There are subjects suited to all of these plans, and it often requires much study and care to know which is the proper one to adopt. Where the operator is unable to decide which is best, we would advise an entirely plain background.

The principal objections to the mode of operator No. 1 are, first, the resulting picture often has a *cut-up*, *patchy* effect, in which the proper breadth of light and shade for a fine artistic effect are destroyed. Second, a homely feature (or maybe a homely face) is made too prominent, by contrast centring interest to that part. In the pictures of No. 2, breadth is secured and a fine result often obtained, but unless the subject is entirely suited, a plain ground would be best.—"Pyro."

sires to improve; for, by giving too much relief, a dry, hard effect—cast-iron it might be called—is produced; by too much softness and blending of the parts, woolliness and insipidity; and in a desire to preserve a breadth of effect there is danger of producing flatness.

RELIEF is desirable, to a certain extent, in all our productions, and the larger the work the more relief required; but, as has been said, we should be careful not to get too much.

HARMONY depends upon the intermediate parts of a picture serving as a link or chain, either by conveying a sensation of the same light or shade with those in immediate contact, or by reducing, neutralizing, or breaking down entirely the harsh asperities of the two extremes, and thus producing a connection or agreement,—a fallen tree leading across the turbid stream from the darkness of the wildwood to the bright sunshine on the other side.

85. BREADTH OF EFFECT is only to be produced by a great extent of light or shade pervading the picture. If an open, daylight appearance is intended, it will be best produced by leaving out part of the middle-tint, and allowing a greater spread of light and half-light; in this way one may also give the darks the relative forces which they possess in nature. If a breadth of shadow is required, the picture ought to be made up of middle-tint and half-dark. In the one treatment the dark ought to tell sharp and cutting, which is the characteristic of strong daylight. In the

85. When too much light is reflected on the shaded side of the face it prevents the spectator from tracing the direction of the principal illumination, and, trivial as this statement may seem to those who have not considered the subject, it involves the most important characteristic of a picture, that of unity. Unity cannot be obtained without breadth, and the quality of breadth is entirely dependent on the eye being able to trace with facility the direction of the illuminating force. The idea is a perfectly natural one. The sun's rays at any given moment sweep through the entire landscape, casting shadows in but one and the same direction, and this is the type of breadth. It establishes, by association and the analogy of nature, a law in our minds to which all representations of natural objects should conform; and the simplest form of picture, that containing but one object, as a face, is just as much subject to this law as the presentation of miles of landscape, with its infinite diversity of objects.

Very much allied to the notions of unity by breadth is that of massing the light and shade, keeping each in its separate place, the lights on one side of the face, the shadow on the other. The same illustrations which show the first law exhibit the second. Where a simple object, as a cube or a globe, is presented to the sun, we see easily the separation of these masses, sharply divided in the two sides of the cube, graded into each other in the globe; and it is quite as essential, to the unity of a composition, that the shadows be united

other the lights ought to appear powerful and brilliant, enveloped in masses of obscurity. When shadow is carried beyond the necessary depth for the relief or distinct marking of the several parts, it gives the effect of breadth to the picture, from the fact that it absorbs many of the half-tints and renders the dark less cutting. It also has the influence of repose, as fewer of the outlines are visible.

86. A few explanations further, using imaginary pictures, but trying to make them plain to you. Let us imagine ourselves in a railway tunnel or cave, say twenty feet from the entrance, and looking out. Now, by a lens outside, let the light be collected into a focus and thrown obliquely upon one of the walls of the tunnel. We shall then have explained to us one of the principal properties of light, upon which many of the old masters have doubtless formed their principles of light and shade. Where the bundles of rays are collected, the light is increased in brightness; and when they become more diffused and spread out, it naturally becomes more feeble, losing itself in half-tint. In the experiment suggested to your imagination, we have some of the most essential qualities of light as applicable to photographic portraiture. We have a principal light, which, being produced by the collecting of the rays, leaves that portion of ground the darkest which comes in contact with it, thereby assisting its brightness. We obtain an innumerable variety of gradations until the light is dissipated and lost.

87. Now, the question may be asked, how can these properties be made use of in the management of the light and shade of the picture? As fol-

into one mass and the lights into another, as that the direction of illumination should be discoverable and single. As in the other cases, the type has its foundations in nature and the laws of the mind, and obtains in complex as well as in simple forms. If our globe were at all rough or irregular, it would follow that the grading of the masses must correspond. The human head is approximately an irregular sphere, and we find the masses of light and shade it presents broken and varied.—W. J. Baker.

86. Burnet very justly says: "Every light, however small, ought to have a focus, or one part brighter than another, this being the law of nature; and for the same reason we ought to have one portion of a dark more decided than the rest. Bring these two extremes together and they assist each other, one becoming darker and the other brighter from the effect of contrast. If they are placed at the opposite sides of the picture, we have greater breadth and a more equal balance."

87. If, now, the chemicals are in every direction in perfect order, and the carrying of the process of the plate from the beginning of coating it with collodion till fixing it after redeveloping is well executed, why does not the negative show the result of complete harmony in all its details? The fault will be found in an imperfect lighting of the subject, for surely

lows: Let the principal light, or focus of light, be on the upper part of the face; then allow the light to fall down on the figure, and you thereby produce a union, and an appearance of light giving out rays of the same hue as itself. This was Rembrandt's plan, who rendered the most complicated compositions subservient to the simplest principles of light and shade, and who was equally happy in his portraits of single figures. Further on, an effort will be made to explain more fully his method of lighting.

88. Now, again, imagine yourself in the tunnel, and the focus of light coming towards you directly from the centre, gradating to the extremities, with a border of dark binding in the whole. By this mode the light has great brilliancy, as you will see, giving less breadth, but less contrast—a soft union of the lights with the shadows. It need hardly be repeated to you, that upon the management of light and shade depends the general look of the picture There is an art, too, in their management and disposition, and that art can only be acquired by close attention and the careful examination of the works of those who have excelled in it.

89. Having now spoken of the *manner* of lighting the subject adopted by Rembrandt, a further explanation of what his method was becomes necessary. Rembrandt was in his early days a great stickler for bright light in his pictures, often at the sacrifice of other qualities, and in his first

there will not be any more details on the picture than are to be found on the ground-glass in the camera, after having focussed properly and exactly.

As to the appearance of the picture on the ground-glass, it ought to contain a general brightness and a soft gradation between high-lights and deeper shades, in order to give the picture a perfect relief, not forgetting the drapery, furniture used for posing, and background, the proper lighting of which is also important for the harmony of the whole picture. Knowing his chemicals, the photographer will be able to expose his plate just the right time, which is of no little importance.—J. K. Wolowski.

88. Reynolds says: "The same rules which have been given with regard to the regulation of groups of figures, must be observed with regard to the grouping of lights; that there shall be a superiority of one over the rest; that they shall be separated and varied in their shapes; and that there should be at least three lights. The second lights ought, for the sake of harmony and union, to be of nearly equal brightness, though not of equal magnitude, with the principal."

89. The Rembrandt light means a limited strong light, not all over the face, but just merely on the forehead—a small portion of the forehead—and a little on the nose. The rest of the face not total darkness, but you can see in the darkness—*clair-obscure*—light in the shade. There is Rembrandt again. The Rembrandt is dark, and yet you see everything in the picture, because it is all transparent. It is just like going into a cellar; at first you do not see anything, but as you remain two or three minutes you begin to see everything. That is *clair-obscure*—light in darkness—everything visible and yet in the darkness.—D. C. Fabronius.

works it frequently forms a circumscribed spot, for, as Reynolds has observed, "that light must appear the brightest which is surrounded by the greatest quantity of shade." His plan is followed by many photographers of the present day. They select the face of the figure for a blaze of light, and work their chemicals so intensely as to make hair and drapery so black that the beautiful half-tones that should be secured in the flesh are entirely gone. An example of this will be found in the portrait herewith, of Rembrandt, by himself.

Fig. 24.

90. This is a mistake. All know that the sun-burned people of the country like "nice white faces," but they must be educated to what is tasteful and right; or, if the photographer *must* give in, let him manage some way to introduce other lights into the picture to detract somewhat from the face, and prevent it from looking quite so glaring. This can be done in very many ways, governed by circumstances; for example, a handkerchief in a side-pocket, a book held open in the hand, the hands folded on a chair, and dark cloth, or some-

90. It is hardly necessary to observe that I do not advocate such violent contrasts as would destroy all transparency in shadows, or all detail in the lights. But I do maintain that this style of lighting, judiciously managed, frequently reveals a beauty in nature, whether contemplated in landscape or human faces, that would never be seen in the mild contrast of a diffused light. No cultivated eye has failed to observe this fact, and no experience, it matters not how limited, but has had occasion to note, under the ever-varying conformations of nature, how frequently contrasts will best subserve the purpose of displaying its beauties. Frequently by this means lines are so softened, and angles so rounded or modified, as to turn what otherwise would be harsh and unsightly almost into the very poetry of form and expression.

I have taken pains to test the effect of this style of lighting upon hundreds of subjects, watching closely its advantage or disadvantage upon merely personal beauty as well as its effect upon the mind of the sitter. From want of cultivation or taste, most sitters dislike strong shadows; but even in such cases, if you submit proofs of the two styles of lighting, the Rembrandt effects will so much better display the personal good points of the subject, that in eight cases out of ten this style of lighting will be selected, the natural prejudice against strong shadows being overcome by the greater desire to be beautiful. The photographer should take advantage of these conflicting elements as pointing the way by which the public taste can be educated up to a proper appreciation of really artistic photographic compositions.—D. H. Anderson.

thing draped near them, so as to bring out the light more prominently—in a hundred ways one may counteract the evil spoken of with useful effect. A good study in this direction is given in "Orpin, the Parish Clerk of Bradford," by Thomas Gainsborough, as the light on the hands and on the edges of the book show.

FIG. 25.

91. But Rembrandt's *extending of the light through the picture* gradually became more enlarged. He finally illuminated even his darkest shadows by streaks of red, or rich brown color, running into them. The same effect may be secured by the photographer if skill be exercised in lighting. One of the greatest charms of Mr. Adam Salomon's exquisite work is in this very thing. While there seems to be considerable clear glass in his negatives, judging from his prints, yet, when we examine them, little delicate streaks of half-lights are seen dancing about here and there, like colors in a dew-drop, giving a tone and charm to the picture which is truly fascinating. Very often, in a composition picture, accessories may be introduced to receive the light and secure the desired effect of light and shade. A ray of light falling into the operating apartment upon a light object, may, as in nature, reflect back the rays and illuminate the surrounding objects, giving thus the principal light the properties of light itself.

91. My method of securing these brilliant effects is as follows: I place behind the model, to serve as a background, a large window of glass of the color of red fire. This background window is placed on the best lighted side of the studio, so as to secure the most luminous and transparent effect. The model is placed about twenty inches in advance of the window—just a sufficient distance, in fact, to permit the moving of the head-rest. At a greater distance the effect would not be so good. The size of the window may be determined by the artist in relation to the class of work he may wish to produce, and the glass should have a simple frame of wood. The oblique rays of white light are especially effective, and, combined with the red light, permit of the production of some very interesting and varied effects. By varying the position of the model in relation to the window, the varied combination of the white rays with the red present some very interesting points of study, and the process produces images in very powerful relief upon a black background peculiarly transparent.—ADAM SALOMON.

92. The shadows of all objects receiving such rays, we shall generally find well defined, as in nature, and Rembrandt frequently introduced such objects for the purpose of producing lights, giving an appearance of truth to the whole effect. At other times we find the shadows swallowed up in the splendor of light, as if afraid of disturbing its breadth. He always had some end to accomplish, and that should be the plan of the photographer who desires to excel. Have a plan, a purpose, and work up to it. To illustrate, a copy of Rembrandt's celebrated group, "The Syndic of the Cloth-Mongers," is given. The original is now in the museum at Amsterdam, and is one of the wonders of art.

Fig. 26.

93. It may not be out of place to give a few examples in the practice

92. One of Dr. Johnson's definitions of softness is "vicious delicacy," which admirably expresses its relation to art. Now I look upon gradation as one of the most valuable of art qualities, which may be defined, in contradistinction to softness, as delicacy without vice. Gradation will include every tint and tone between absolute white and absolute black. It is true that, in a limited sense, every progress of one tint into another, however narrow the scale, is a gradation, and would therefore include softness; but in art the word gradation is used to express a much wider scale than can be included by the word softness. Ruskin says there can be no true gradation that does not include the extremes of black and white—the whites to be precious, the blacks conspicuous. The whites tender and delicate, and limited, if you like, but bright and lustrous where they are required (and they are required in every picture); the blacks must be conspicuous—however small a piece of black may be, it ought to catch the eye. There is gradation in every inch of nature; but without the judicious introduction of pure black and pure white, the luminous beauty to be gained by ever-varying gradation is lost, or becomes that "vicious delicacy" called softness.—H. P. Robinson.

93. I am considering the pose of my sitter and the lighting. I judge that the dark space behind will absorb or obliterate the dark side of the sitter, and I cannot well put there a light, permanent screen,—*that* would cut him in two by its line,—so I ask my assistant to take that little white canvas screen on a stretcher and move it behind the figure while I yet have

of *chiaro-oscuro*, or rather to illustrate the same. When the light part of the composition is placed upon the dark side of the background, and the dark part upon the light side, greater firmness and solidity are produced, and a more equal balance is kept up. The contrary method has more breadth and softness of effect, but there is danger of the picture being flat. In a single head, as we often have but one light, it is therefore necessary to get it to harmonize with the shadow, either in the background or upon the dress. This you may secure by throwing your light on your side-screen in a way that the drapery will be lighted about the same as the shadow side of the face. When the principal light is kept at one side, there is an opportunity of introducing a larger portion of shadow than when the light is in the centre, which is often of much consequence. Our object in photography should be to get neither too strong light nor too strong shadows. Both are repulsive and both are equally inartistic. Modulation in all proper places, in quantity to suit circumstances, is the best, and should always be sought after.

94. The adoption of a purpose, and the striving to attain it, has been advised. "To form the purpose is one thing," you remark, "and to accomplish it is another." Very true; yet a photographer has more under control in his studio than he sometimes imagines. He sees the work of others superior to his own. The lighting of the figures seems to strike him as the main source of beauty,—and truly so, perhaps,—and he forth-

my plate in the bath. I now look into the camera, and as he moves it at the rate of two or three vibrations in a second, I direct him: "A little higher;" "a little further back;" "there now;" "a little lower;" and so forth, just as I imagine the light should be, according to the outline of my sitter. When I am satisfied with the light, I make my assistant notice how far he has extended the screen forward and upward. I now insert the plate, and expose the figure with the full, dark background behind him, but only for a moiety of the time I intend for the full exposure; then I cap the lens for an instant, while my assistant takes the place to which I had schooled him. He then commences to move the screen in the proper manner, when I again uncap the lens and complete the required exposure. It was in the way here described I took the well-known portrait of my friend Gustave Doré. From the movement, the outline of the white screen is entirely lost, and it gives a beautiful graduated effect. Even when you want an entirely light background, it is better to expose at first for a short time with the dark ground, afterwards inserting a light ground; for a face taken in this way is finer than when a uniformly light ground is used throughout.—O. G. Rejlander.

94. Now this admired, but certainly not admirable, softness is a totally different quality to gradation, for which it is sometimes mistaken, just as adulteration may be sometimes nearly undistinguishable from purity, except to the taste of the adept. Softness is that sort

with proceeds to tear out and rebuild his glass-room, all the while having it in his power to secure the same results without the expense and trouble of alteration, if he but use what brains he may have in applying himself to the work. His light may be the same precisely as that of his more successful and *skilful* neighbor, but he cannot produce as good effects, for the reason that he has an idea it is "all in the light," or in some "secret formula" unknown to him. He can produce pictures, black and white, such as have been described, or he can, by covering up his defects by the application of the "patent mezzotint" or "softness" dodge, secure prints fuzzy, feathery, flat, and feeble, entirely void of force and vigor. But neither of these are what you should make the effort to produce.

95. Study and imitate the works of others. Do not be confined to those of photography, however. There is much, very much, outside of them worthy of study, in the multitude of engravings and drawings to be seen or had almost anywhere. Some of the grandest studies of light and shade are to be found in the engravings in old books to be had at the book-stands. The habit of studying such is a very laudable one, and will repay for the time it takes. It is a good plan, too, to collect a series of engraved portraits from the paintings of many of the old masters, copy them, and mount photographs of them all on one board. These can be studied with great benefit, and will be found to aid much in managing the *chiaro-oscuro* of your pictures.

96. As in photographic manipulations a photographer should not only know that certain combinations of chemicals produce certain results, but *why they do so*, so in studying and finding out the beauties of the work of

of muddled effect that has no high-lights nor brilliant touches of black, as though the photographer was afraid of the wide gamut of light and shade afforded him by his art, and could only venture to play a few notes in the middle of the scale—a sort of dull pictorial mud, without life or pluck.—O. G. REJLANDER.

95. Sir Joshua Reynolds has truly said: "The great use of studying our predecessors is to open the mind, to shorten our labor, and to give us the result of the selection made by those great minds of what is grand or beautiful in nature; her rich stores are all spread out before us; but it is an art, and no easy art, to know how or what to choose, and how to obtain and secure the object of our choice. Thus the highest beauty of form must be taken from nature, but it is an art of long deduction and great experience to know how to find it. We must not content ourselves with merely admiring and relishing; we must enter into the principles on which the work is wrought; they do not swim on the surfaces, and consequently are not open to superficial observers."

others he should be able to tell why and how such beauties happen to exist. This taxes his knowledge, his taste, and his inventive genius, and is capital exercise. The true photographer is not content, either, with the quiet acknowledgment of the superiority of the works of others over his own. He finds out by thought and experiment how the perspective is secured, how the composition is arranged, how the light is disposed, and all the purposes of the artist in making the pictures. He looks and studies until he has a good, distinct idea of what makes any picture beautiful, and with the means at hand endeavors to imitate the good and overcome the objectionable.

97. What is learned by such hard study is not apt to leave one, but will influence him in his daily work for good or bad: therefore be taught rightly. A few final hints on light and shade may be useful. Always have the management of the light uppermost in your mind. A subject ever so gracefully posed is easily spoiled in lighting. Let that part of the picture which is of greatest importance—the face—be the subject of your special care. When introduced to a stranger, our attention is first directed to his face; and so it is with a picture. Light your *face* well, then; give good exposures, and you will secure effects that will reward you for your care. At the same time do not overlook those helpful appendages in every picture—*the hands.* They may *spoil* your composition, or they may serve largely in making it. They are never to be disregarded, even if they do not show in the picture, for their disposition has much to do with the carriage of the body.

97. Lavater told Goethe, that, on a certain occasion, he held the church-bag for the collection of offerings from the people, when he tried to observe only the hands, and satisfied himself that in every individual the shape of the fingers and hand, and the action expressive of the feeling in dropping the gift, were distinctly different and characteristic.

Thus we see how important a member is the hand; second only to the face in its capacity for expression, it should receive nothing less than secondary attention, and be kept in harmony with the face, as well as with the whole action of the body, whatever may be represented. The hand should be studied with as much care as the face. There are twice as many of them; we see them in our daily life under all conditions, and doing all sorts of things. Wherever we see one that is pleasing, make a note of it; remember it, and the time will soon come when in our daily practice we can make the hand of some sitter take the same beautiful form that impressed itself upon our own mind. When we see a hand that is not pleasing, let us consider why it is not so, and remember it as well as the other, so as to avoid ever photographing one like it. Thus we learn; and let us remember that every picture is made up of parts, details, all of which require careful attention, and there are none more important than the hands of our sitters.—"YOUNG CHLORIDE."

98. The wondrous potency of composition—lines and effect—is displayed in the closing illustration of this lesson. In it we have examples

Fig. 27.

of all the various forms of composition; all the varieties of lines; light and shade; perspective; balance; unity; Rembrandt effects; massing of

98. After man has fulfilled all of his requirements *as an animal*, in making himself secure against his neighbor, a superior life dawns on him—that of contemplation, by which he is led to interest himself in the creative and permanent causes on which his own being and that of his fellows depend, in the leading and essential characters which rule each aggregate, and

the lights; action; repose; the careful introduction of accessories; and, if we could hear it, doubtless there is perfect harmony, also, throughout. It is a wonderful study, and will reveal its merits to you—show you new beauties afresh each time you examine it. It is full of excellent lessons and suggestions, and is produced strictly upon the principles just expounded.

99. This endless subject must now reluctantly be dropped here. It has not been exhausted by any manner of means. In the beginning, the most that was hoped for was to *interest* you sufficiently in it to help you comprehend its importance, and to know somewhat of its nature. If this has happily been accomplished, then, from being sensible of *the effects* of art from instinct, you are already so far advanced as to be able to reason out the causes of your respect and esteem for it, and it will become a part of your nature—of your life. And if it has thus become

impress their marks on the minutest details. Two ways are open to him for this purpose. The first is science, by which, analyzing these causes and these fundamental laws, he expresses them in abstract terms and precise formula. The second is art, by which he manifests these causes and these fundamental laws no longer through arid definitions, inaccessible to the multitude, and only intelligible to a favored few, but in a sensible way, appealing not alone to reason, but also to the heart and senses of the humblest individual. Art has this peculiarity, that it is at once *noble* and *popular*, manifesting what is most exalted, and manifesting it not at all.—N. TAINE.

99. "Ah! what do you ask about art? I can say nothing that shall satisfy you. Ask about love, that is my art; in it I am to perform, in it I shall recollect myself and rejoice. . . . ."

But this breaking forth to light of the mind, is it not art? This inner man asking for light, to have by the finger of God loosened his tongue, untied his hearing, awakened all senses to receive and to spend; and is love here not the only master, and we its disciples in every work which we form by its inspiration?

Works of art, however, are those which alone we call art, through which we think to perceive and enjoy art. But as for the producing of God in heart and mind overpowers the idea we make to ourselves of him and his laws, which in temperate life are of value, even so does art overpower men's valuing of it. They who fancy to understand it will perform no more than what is ruled by understanding; but whose senses are submitted to its spirit, he has revelation. All production of art is a symbol of revelation, where the conceiving mind is often more imparted with revelation than the producing one. Art is witness that in our world the language of a higher one is plainly to be perceived; and when to explain it we venture not, then it will make us ready for this higher spirit's life, of which it is the language. We want not to understand it, but to trust in it; faith is the seed through which this language spirit germs in us; so as all wisdom springs from faith, as it is the seed of an immortal world, as the highest wonder is true, all that lies there between must be an approach to truth and but the judging mind of mankind misleads. What, in fairness, may and dares make us wonder, but our own meanness?—BETTINE VON ARNIM, IN "GOETHE'S CORRESPONDENCE WITH A CHILD."

a part of you, then it will pervade your every act when prosecuting the department to which you are devoted, and mould you and influence you in its own sweet, seductive way, until you *live* it, and the results of your study and labor will show its impress upon them to a degree that will surprise and delight all for whom you labor. Your works *will be you*, and you will be honored and patronized as you deserve.

100. The preceding pages have been devoted more especially to the treatment of the *portrait* subject, although some of the illustrations have pointed somewhat to work out of doors, necessarily, as the same rules of art come into play with *all* classes of subjects. Further on, the fascinating department of landscape photography will be attended to, with different illustrations and notes.

Use the instructions given with due abstinence, and they will act as a healthful tonic in your work; indulged in intemperately, as an enervating opiate. Stick to stern realities, and do not let them be usurped by visionary ideas. Measure things for what they are worth, and not on account of the day dreams they engender. If your imagination is allowed to transcend these rules of art, some of you will be made lunatics by them, some somnambulists, and very few attain the heroism of art. Enthusiasm is good when controlled. Only a staff is given you here to walk with—only the *suggestion* that you *must* walk by principles, to succeed.

As a final illustration of photography done upon art principles an excellent phototype by Mr. F. Gutekunst follows. Here are eleven pictures of one person, in as many attitudes, showing that when *art* is used as a helper, there is much more than one set position attainable for every model presented for a portrait. As studies *with* the rules here so imperfectly explained, these pictures are invaluable. Please to give them studious attention.

100. Art is the microscope of the mind, which sharpens the wit as the other does the sight, and converts every object into a little universe in itself. Art may be said to draw away the veil from nature. To those who are perfectly unskilled in the practice, unimbued with the principles of art, most objects present only a confused mass.—HAZLITT.

Excellence in art is to be attained only by active effort and not by passive impressions; by the manly overcoming of difficulties, by the patient struggle against adverse circumstances, by the thrifty use of moderate opportunities. The great artists were not rocked or dandled into eminence, but they attained to it by that course of labor and discipline which no man need go to Rome or Paris or London to enter upon.—HILLIARD.


MISS ADELAIDE DETCHON.
F. Gutekunst Photographer

LESSON B.

THE NEEDFUL APPARATUS.*

101. THE choice of apparatus and materials with which to work should have the wisest attention in photography. If good results are to be secured, then the wherewithal to produce them of the best quality must be employed invariably. In no department of the arts or of the sciences or manufactures is this more true than in photography; therefore the good rule—*get the best*—should be carefully followed in the purchase of all the articles employed in its practice.

102. Let us therefore proceed to inform us—1, as to what are needed; and, 2, as to how to select them; or, in other words, how to procure the proper outfit for the practice of photography in and out of doors. *The camera* comes first. This must be absolutely first-class in every respect—compact, light, strong, exact in all its parts—made of carefully seasoned wood and well wrought metal, carefully put together with all modern improvements, with the best workmanship throughout. The cameras supplied now by our American manufacturers leave nothing to be desired; they are the best in the world. So there is no excuse for the purchase of an imperfect or spurious one, whose movable parts will not work; which allows light to creep through its joints, thus spoiling every attempt to get a good result with it; or distorts all nature villanously.

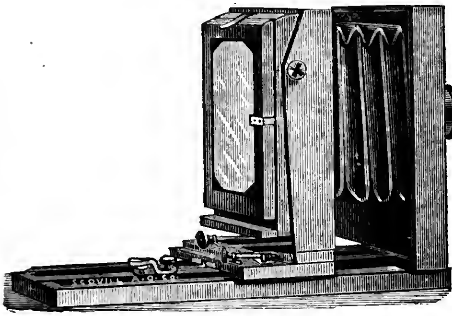
103. A modern camera comprises a dark chamber, varying in size according to the dimensions of the picture to be made with it, which is provided with a bellows and focussing machinery, by means of which the image may be sharply defined through the lens upon the ground-glass at its back, the lens being placed at the front. The ground-glass,

* The illustrations in this lesson were made from apparatus manufactured by the American Optical Company (Scovill Manufacturing Company, New York, proprietors) especially for this work.

after a focus is procured, is displaced by a dark-slide, containing the sensitive plate which is to receive the image of the object being photographed.

104. The Portrait Camera is usually constructed with a square bellows, long enough to permit such distension as will enable us to make various sizes of pictures with it. It is heavier than the view camera, provided with a longer platform and a double "swing-back." This last convenience is for the purpose of enabling one to change the position of the plate when difficulties occur in focussing. When lenses of short focus are used, for old people and children, the "swing-back" is a great help. It also saves much annoyance, both to the operator and his subject, for frequently an entire change of position or arrangement would have to be made, or the place of the apparatus changed, were it not possible to accomplish the desired end by means of the "swing" or adjustable "back" of the camera.

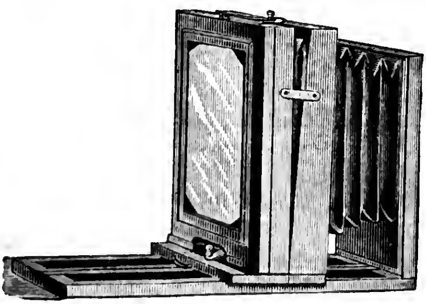
Fig. 28.



PORTRAIT CAMERA.

105. The View Camera of the American apparatus-maker is his pride. He has applied all his ingenuity to its construction, to make it light, strong, convenient, accurate, and elegant in appearance. In principle it is precisely the same as that of the portrait camera. In construction every effort is made to secure a decrease of weight. The bellows is made of "cone" shape; the framework of the toughest and strongest wood; the metal parts of the most improved form, and the whole so skilfully put together as to stand any climate and much abuse, as well as use, before it gives way. In a view camera the "double swing-back" is absolutely essential, and the plate-holders should be so constructed as to enable one to make the view vertically or horizontally.

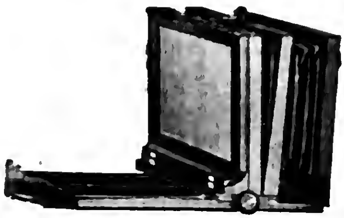
Fig. 29.



CONE-BELLOWS VIEW CAMERA.

106. THE STEREOSCOPIC CAMERA may be mentioned as a form largely used in America, and, although a *view* camera, it has a few points which are different. It is made after the plan of the view camera, but so as to use two lenses, that a double image may be had at one exposure upon the same plate. Modern ones are provided with a movable division, so that the same camera may also be employed for taking a single view with one objective.

FIG. 30.



'76 STEREOSCOPIC CAMERA.

The best size for such work is 5 x 8 inches, and this sort of a camera is the best for a beginner in out-door work to employ, until he can aspire to something larger. Anything smaller is unsatisfactory, and insufficient to inspire much enthusiasm for out-door photography. The regular view camera is made of all sizes from 4 x 5 inches to 22 x 28 inches, or even larger when required.

107. HOW TO TELL A GOOD CAMERA.—As a usual thing, the modern American camera of the best quality is assuredly "all right" at the time of purchase. It may be well, however, to know how to test its quality. It may "leak" light. If it does, it will fog and spoil every sensitive plate you trust to its care. To prove its good faith with you, cap the lens, remove the ground-glass, and, with focussing-cloth tightly over you camera and your head, peer into it for intruding beams of light. If none are seen, your camera is so far faultless. Now you understand that the inside of your "ground-" or "focussing-" glass receives the reduced inverted image of the object you are about to photograph, and that by the adjustment of the lens you there secure it defined to the highest degree. This surface is replaced by the sensitive film, when you are about to expose, and the last must take the place of the first exactly, or your picture will be "out of focus"—illy defined. Therefore, if you have focussed carefully upon an object, and after taking a picture you find that the object is not defined so accurately as you saw it upon your ground-glass—as it should be—then there is a lack of coincidence between the chemical and visual or actinic foci; the camera is at fault, and must be so altered as to produce the proper result.

108. CARE OF THE CAMERA.—Once possessed of a good camera, learn to take excellent care of it. It is not made for abuse, neither should it be

expected to stand combat with the elements like a plough or a mowing-machine. Remember this: Once knowing that bad results are producible, damage possible, do all in your power to prevent them; exercising always every care. "Dirt is matter in the wrong place," says the philosopher. *Light* is dirt when it intrudes at the wrong time into the camera or upon the sensitized plate. Keep it out and off by covering the camera when in the sun, and carrying the holders containing the sensitized plates *also* covered. Cover up the camera, when not in use, from wind and storm, dampness and sunshine. Keep it cleaned from splashings of silver and droppings of dust. Some manufacturers supply flannel coverings with each elegant camera they produce. These should always be used.

109. The Camera-Stand is used to so place the camera in relation to the object to be photographed as to secure its image in proper position upon the sensitive plate. It should, for portrait work, be strong, steady, solid, provided with rack-work for raising and lowering it, and with an adjustable top by means of which a proper inclination of the camera can be had. It should have castors on the two fore-legs, that it may be readily moved about. For out-door work a strong, slender tripod is used, whose jointed legs spread out, thus enabling one to secure any desired height with it, but it often acts with the comic and incomprehensible treachery and perversity of the American mule. Unless extreme care be taken in its management, disastrous results are of frequent occurrence. Never get out of patience with it.

110. Other Articles Needed.—We have us provided now with the apparatus required to make a photograph. For portraiture, various other articles are needed before we can enter the studio for work. Among these are a head-rest, for the proper support of the figure, chairs, backgrounds, tables, and other accessories, with side- and hand-screens in number varying to suit the fancy of the user and the variety of the subjects which come to him. Upon all of these more will be found further on, when work is absolutely entered into. First, we must consider the optical tools needed for our purposes. It shall be done in the next lesson.

LESSON C.

THE OBJECTIVE, OR LENS.

111. PERHAPS the most important of all the apparatus needed by the photographer in this work is the objective, or lens. It should be selected with the greatest care, though, indeed, our opticians now produce lenses of such exquisite workmanship that one runs no risk in making a purchase from any of the well-known makers. The matter of selection, then, lies in the form or kind of lens desired. Any sort of a gun will scare a bird, and any sort of a hammer drive a nail. So will any sort of a lens make a picture. But as excellence is always to be aimed at and after, the photographer should choose the lens which will produce the kind or class of work he desires, of the best quality. *No* lens will do *all classes* of work, any more than one hammer will. It seems to be a rule in optics that if one quality is secured to a high degree, there must necessarily be a compensating loss in some other direction. For example, we

111. Light is propagated in a straight line. We cannot see around a corner. If a ray of direct sunlight passes through a small hole of any given shape into a darkened chamber, and we hold a screen near behind the aperture, we observe a bright image of the shape of the hole. If we increase the distance of the screen and the aperture, the image of the hole disappears in the penumbra, and the round image of the sun takes its place; and, if the hole is small enough, you will see not only the image of the sun, but the image of all the external objects will appear likewise. This is only true when it continues in a medium of the same density, or it enters a medium perpendicular or normal. But, if a ray passes from one medium into another of different density obliquely, its direction is changed—it is refracted.—JOSEPH ZENTMAYER.

I have long noticed the peculiar effects produced by rapid-acting lenses, and by extra sensitive chemicals. In the one case, I have remarked that a certain softness, which is the first and most evident peculiarity of negatives made by rapid-acting lenses with a proper exposure, interferes very materially with the clear brilliancy of definition that is most desirable, and, when not too cold and hard, is the highest attainable perfecting chemical effect; while with the extra-sensitive chemicals the contrary is the most usual effect; the negative is prone to hardness and intensity (when not over-exposed, and then it is fogged), and lacking in definition, a very bad quality, and not to be tolerated except under compulsion.

It will thus be clearly seen that the rapid-acting lens, when used with full aperture smothers the image with its full volume of light; while the lightning collodion does not give

may secure depth of focus, rapidity of action, and exquisite definition, but only at the expense of the size of the image. For as you increase the latter, you decrease the other good qualities named.

112. All lenses either scatter (diverge) or concentrate (converge) the rays of light which are transmitted through them. They are, for convenience in grinding, all made with a curved surface or surfaces, and are usually of the following forms: 1, double-convex; 2, plano-convex; 3, concavo-convex; 4, double-concave; 5, plano-concave; 6, meniscus. The effect of the curves of a double-convex lens, say, would be to collect the parallel rays of light which pass through it to a point or *focus*, while those of the double-concave lens would scatter them, and the other forms more or less converge or diverge, according to their forms. In order, then, to prevent the distortion or spherical aberration which would occur if single lenses only were used, opticians resort to combinations of lenses of various forms together, and to the use of diaphragms or stops. But a few years ago the photographer had but two grades of lenses to choose from—the single combination and the double combination, the former for landscapes and the latter for portraits. Much more attention has been given to their wants of late years by opticians, until now it becomes

a properly balanced effect, because of its extreme sensitiveness; the diffused light admitted through the lens (an always appreciable amount) fogs the shadows under a fair exposure, and with a shorter time the high-lights are unduly affected, and harshness results.—E. M. ESTABROOKE.

112. Many of you are aware that in nearly all human eyes there exists an aberration, also called astigmation. Although in its effect similar to the astigmation of lenses, just mentioned, it is of a different character. Nature intends that the curves of the cornea and crystalline lens of the human eye should be spherical; but the exceptions seem to be the rule. The curves of the cornea and crystalline lens of the eye are, in nearly all cases, more or less elliptical, egg-shaped, and consequently have in one meridian a longer focus than in the other. If such an eye brings the image of a line parallel to one meridian to a focus at the retina, the images of lines parallel to all the other meridians do not collect at the retina, especially the one at right angles to the former, and a distorted, blurred image is the result. The advancement of science has lately enabled our oculists to correct this evil by spectacles, of which the glasses are parts of cylinders instead of spheres.—JOSEPH ZENTMAYER.

The lenses in a portrait combination are occasionally removed from their cells for the purpose of cleaning. Generally speaking, it is sufficient to unscrew the mounting and wipe with chamois leather the two surfaces exposed. They can then be easily replaced; for the brass fittings are usually so made, that if by mistake the cells are screwed into the wrong places, the hood, or projecting shade, will not go on. The mistake is, therefore, easily detected and corrected. When, however, the lenses themselves are taken out of their cells—and, except for curiosity, this is rarely required, for the inner surfaces do not become dirty,

somewhat a difficult matter to select. Knowing the class of results you want to secure, however, it is a comparatively easy matter to find what will satisfy you.

113. A brief description of the various forms, and an idea of what they are intended to accomplish, will therefore be all that it is necessary to give here, so often have the lines and principles and forms of the various grades and kinds of lenses been given in more pretentious works. We have then: *First*, the "single" combination, for use in making pictures of objects without motion, when the time of exposure is not necessarily a consideration. They are usually of longer focus than the double lenses, and therefore a much larger picture may be obtained with one of a given diameter than with one of the double form. *Second*, the "double" combination, which works with greater rapidity than the single, for the following excellent reasons: Behind the first pair of lenses a second pair is placed, which so intercepts the rays refracted from them as to cause them to focus about one-half the distance of the other, thus making them work with far greater rapidity. *Third*, we have the "triplet" combination, wherein a third pair of lenses is added, or such a combination as to diminish the distortion or obliquity of the rays which pass from the front pair, thus making it the most desirable form for landscape work.

114. These three combinations give us, then, for the two great classes

like the outer ones—the case is very different, for they may be variously transposed, and thus rendered incapable of producing good pictures. There is a risk, also, of breaking one of the glasses of the back lens in screwing it in, unless it be put together in the proper manner. Many good lenses have been condemned as hopelessly bad through being thus transposed.—JABEZ HUGHES.

113. In a portrait combination there are four lenses in all, the so-called *front* and *back* lenses being really each formed of a pair. The front ones are always cemented together, and may thus be easily taken for one lens; the back pair are distinct, and are usually separated from each other by a narrow ring. To place them in their proper positions, proceed as follows: Take the front lens, the pair cemented together, and observe that one surface is considerably curved, and the other almost flat; place the lens in its cell, so that when screwed into the tube the curved side will be to the sitter. The two glasses forming the back lens are very unlike each other; one is thick at the centre and thin at the edge, the other thick at the edge and thin at the centre; put the thin-edged one first into the cell, resting on the least curved side; next put in the ring, and then the thick-edged glass, concave side towards the other lens; fix them in their places with the part provided, and screw the cell in its place. —JABEZ HUGHES.

114. With many portrait lenses there is an arrangement whereby the front lens may be used as a landscape lens; to use it for this purpose proceed as follows: Unscrew the back lens and lay it aside altogether, as it is only required in the *double* combination; then remove

of work, portraiture and landscape, the necessary rapidity and correctness of figure or freedom from distortion, with all the roundness, depth, detail, and sharpness of outline which we see in nature. As to dimension, that is governed by the length of focus of the lens used. Given a lens of a certain diameter, the size of the picture will increase with the focal length of the lens, and *vice versa*. It is also increased or diminished according to the convergence or divergence of the lens.

115. There are four other points which must be borne in mind when operating with lenses. 1. If you place the lens too near the object to be photographed, or fail to use the proper diaphragm, so as to stop the action of the lateral rays, you lose definition, obtain an insipid image, and, for your pains, have a distorted picture. 2. If you use too large a diaphragm, or increase the length of focus in the camera, you lose a quality in your pictures known as *depth of focus*. 3. The illumination of your subject, the size of the diaphragm used, and the focal length of your lens, all govern the time of exposure. 4. Some lenses are so carelessly "corrected for color" as to cause the rays to overlap one another, and thus destroy the quality of *definition*.

the brass hood before the front lens; next unscrew the front lens and rescrew it in the place where the back lens was. In doing this the *flat* surface will be presented to the object. The lens tube may be now put on the camera, and the central stops will be in their proper place for use. As the focus of the front lens, when thus used singly, is much longer than when used in combination with the back lens, the picture it will yield is proportionally larger, but a much smaller stop must be employed.—JABEZ HUGHES.

115. Now, knowing all the defects of lenses, and the different modes of correcting the same, let us look back to that primitive instrument—the pinhole camera. The pinhole camera is free from all the errors, as spherical and chromatic aberrations, distortion, curvature of field, astigmation, and the only objection against it is the extremely small aperture. What an amount of speculation and hard labor of the most eminent men was necessary to furnish a substitute, equally free from errors, having a larger aperture, giving a brighter image. And, even now, none of the aberrations can be completely corrected, and the best that can be done, and that for a limited aperture only, is to reduce the errors so far as to diminish their extension, so as to make them appear to our eye at a smaller angle than the eye is able to distinguish. In lenses used as objectives, where the image is magnified by high eye-pieces, even that is extremely difficult, as the errors are also magnified. Our most celebrated opticians, such as Fraunhofer, never attempted to give a telescope objective a larger aperture than the focus divided by ten, except in very small pocket telescopes. And his larger telescope, the one he made for the Dorpat Observatory, and which he considered his best objective, has a focus of one hundred and sixty inches, while the aperture is only one hundred and eight lines, that is one-seventeenth of the focal length, and its highest magnification is seven hundred and twenty times. The larger telescopes of Dollond are nearly twice as long. The same artist, Fraunhofer, took precaution to warn young opticians

116. If a lens be found faulty in this respect, it should be returned to the seller. Indeed, in these days there is no reason why a photographer should "manage" with a lens in the least bit defective. Many pages could be filled describing the various methods of testing lenses; their varied constructions and grades, and abilities. That seems so much to be the business of the dealer in them as to be uncalled for here, and it is omitted. If you want a new lens, you are supposed to know what you want it to do, to begin with. The dealer in them should be able to supply you with what you want, and, as a usual thing, is willing to exchange if your desires are not met with in the first trial. There are so many makers now that one has the *right* to expect every opportunity to select the best, or at least what he believes will answer his purpose best. The excellence of your results and the enjoyment you will have in producing them, depends so much upon your decision in this matter, that you ought to use every means to secure a good instrument.

and amateurs not to listen to the very natural desire to try their skill on large apertures, and giving higher magnification, if they do not wish to be disappointed, and lose time and money. But the school of experience seems to be the only one to cure this desire.—JOSEPH ZENTMAYER.

There are two causes, from either of which such a defect might arise. It may be that the sensitive plate does not occupy precisely the same plane as the ground-glass. This you can only certainly ascertain by very careful measurement, although it is possible that a slight examination will suggest the existence of such a defect. Examine the dark-slide, and see if the corners on which the plate rests are all firm and in their proper position. If these are all right, proceed to measure. Take out the lens, and measure carefully from the aperture in the front to the ground-glass; then remove the ground-glass, place the dark-slide containing a plain plate of glass in its place, and measure again; if the distance coincides, all is right there; if not, make the proper correction. If the fault is not in the position of the plate and ground-glass, it may be in the lens. In some lenses the visual and chemical foci are not coincident—that is, the rays which come to a focus, and give a sharp image to the eye on one plane, come to a chemical foci on another plane. In this case, there is no remedy but obtaining a better lens, or, else, always making an allowance for the defect in focussing.—UNKNOWN.

116. I give below a *resume* of tests made in selecting lenses for a friend. I started with no fixed ideal which the performance of the instruments was to equal. I did not expect a mammoth to "cut" in the same proportion as a ¾ or 2B. Knowing something of the rapidly increasing ratio of the imperfections that have to be equalized and corrected (the spherical aberration increases as the square of the aperture, the chromatic as the cube), I resolved to be contented with the best that leading opticians offered: and here I will say that, as far as I can, I shall refrain from indicating who the makers were. The lenses will be designated as A and B. A was made to order, subject to approval. B was one of a number of the same size ready made.

Test first, of price. A cost over fifty per cent. more than B.

Test second, for whiteness of glass. The lenses were unscrewed, and placed side by side on white paper. B proved to be of much clearer, whiter glass than A, which latter had a rather yellowish-green tint.

117. The use of the diaphragm now demands your consideration. Some idea of its mission and value has already been given. The diaphragm is a piece of metal, wood, or card-board, with an aperture in the centre, varying in size, and is placed before or behind the lens both to *stop* or prevent the action of certain rays upon the lens, and to neutralize their effect upon the negative, even though they do pass through. The diaphragm is, therefore, also called a "stop."

Test third, for comparative ratio of aperture to focal length, B was by measure a fraction of an inch larger in diameter than A. The focal lengths were obtained by measuring the distances of the image from the object (dots twelve inches apart on white card); the image was in each case made the same size as the object when focussed with the full opening. Had a small diaphragm been used there might have been an error, as in this case there is some latitude in focussing. The distances when quartered gave pretty nearly the equivalent solar foci. B had a somewhat longer focus than A, but in each case there was about the same ratio between the squares of the apertures and the focal lengths respectively, from which it might be expected that they would work in nearly equal time, while the superior whiteness of B would be an element in its favor.

Test fourth, for actual time of working. This test was very carefully conducted, repeated several times on different days, always about noon, with a clear sky. A still subject in half-tone was used, and care taken to distinguish between an increase of intensity, which might make the detail in the shadows more apparent, and actual amount of detail obtained with similar and dissimilar exposures. These trials showed that A with forty seconds equalled B with forty-five seconds, a difference of but little practical value.

Test fifth, for definition, made by copying an engraved head of four inches length to the same size with full apertures. Very decided in favor of B.

Test sixth, for flatness of field, made by copying a newspaper to actual size, and by pushing in the ground-glass till the centre letters were barely sharp. Much in favor of B, which had a field of sharp letters almost double the linear extent of A, though it was surprising how small the extent of apparently flat, well-defined field was in either case. When, afterwards, the lenses were tried on standing figures the comparison had the same result.

Test seventh, for marginal definition, conducted with the newspaper as above, by focussing as sharply as possible the letters that came on the outside of the field. A was nowhere with B in this test.

Test eighth, for depth. This I have always, by theory, held to be a quality decided, other things being equal, by the ratio of the aperture to the focal length; and these trials only convinced me of the correctness of that opinion, as there was no perceptible difference. A finely engraved card was focussed, and then slid to and from the lens on a line, as nearly as practicable coincident with the optical axis of the lens.

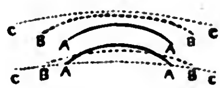
The above seemed to include all the important qualities of portrait lenses valuable in practice; and, to recapitulate, gave tests first, fourth, fifth, sixth, and seventh, in favor of B; tests third and eighth, neutral; test fourth, in favor of A so slightly that I formed in my mind the conviction that while the "best is the cheapest," the highest priced is not always so.—W. J. Baker.

117. The accompanying diagram will give the student a good idea of the action of the diaphragm on a portrait lens. The dark lines, A A, represent the depth and direction of the

118. By the use of diaphragms the definition of the picture is increased, and they increase the focal depth. This, however, is at the expense of light, and a consequent increase in the time of exposure. This latter drawback compels us, in portraiture especially, to give up some of the qualities we should like to secure, lest a too long exposure try the patience of our sitter too severely, or, if he keep still, cause him to assume an unpleasing expression. Thus it will be seen that in photography, as in life, each advantage gained is at the cost of some other, in a measure, and we must be content with a fair medium or measure of what is desirable.

focus of the lens at full aperture. The curvature of the field is purposely exaggerated in order better to show the subsequent result. We will take the *full aperture* to be four and a half inches; it will be observed that in this condition the field is curved—which gives bad definition at the margins—that the depth of focus is limited, which gives enlargement and distortion to all projections, and that the size of the picture is small. Now on placing a diaphragm of three inches aperture between the combinations, the result is represented by the dotted lines B B; it is then seen that the field is extended and depth of focus increased both before and behind the central point D, the consequence of which is that a larger field of clear definition is shown in the picture, and features which before were fuzzy and enlarged in their form, assume their natural aspect.

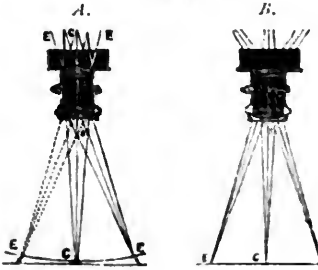
Fig. 31.



If, to include more objects in the composition, or from other motives, still greater sharpness is desirable, a diaphragm of one and a half inch opening is substituted; immediately the qualities recapitulated above are still more improved, as seen in the lines C C. Light has now, however, been much diminished by the small remaining area of aperture, and very considerable addition becomes necessary to the time of exposure.—LAKE PRICE.

118. *A* represents a section of a four and one-half inch double or portrait lens at its full aperture, with the manner in which the pencils of light from the subject pass through the combinations, and are refracted by them to the film. A is the front, B the back lens, C C the central rays, E E the lateral ones, E C E the line of focus at the film.

Fig. 32.



The attention of the reader must be directed to the *width* of the pencils refracted from the lens at this aperture, and the obliquity of the direction of the lateral ones, E E, in order that he may observe the changes which the application of a diaphragm will at once effect in them. *B* is the same lens with the pencils of light drawn to scale; a diaphragm, O D, of two inches aperture, A, is now added between the combinations, the effect of which has been to diminish the obliquity and give more parallelism to the rays proceeding to the film, and more depth in the focus. On contrasting the width of the pencils E E with those in the last diagram, they will be found to be diminished in their diameter by one-half, with more accuracy of delineation, but at the loss of rapidity of

119. The proper use of stops can only be attained by careful observation and practice. It becomes, like exposure itself, almost a matter of inspiration—of feeling, at least,—and no rule can be laid down. A few hints, though, may not be out of place. Each lens is usually supplied with five or six stops of varying sizes. The light, the subject, and the quality of picture you desire are the three governing items in the employment of stops. Study all these, and experiment with *all* the stops. Usually focus with the open lens or the largest stop, and then shift for the one most desirable to use for the exposure.

120. Photography is as susceptible to the variations of time of exposure, the quality and conditions of light, the atmosphere, the chemicals, and the diaphragm employed, as sound is to the instrument, and the other means employed for its production. Hence, there is always much to learn, and great room for careful experiment and practice in all departments. In no other is it more so than in the application of the stop to the lens. Therefore, employ spare time in studying this department of your work, that when you are required to produce the best results, you may go about it most intelligently.

execution by the abstraction of a corresponding illuminating area. The length of the focal distance from the back lens to the film is increased, but with a well-corrected lens of *long focus*, the field, under such conditions of aperture, is very nearly flat.—LAKE PRICE.

119. Enough has been placed before the reader to show him that AREA OF APERTURE is the very helm which regulates and guides the photographic action; if too much diminished, not only the time of exposure becomes irksome, and the expression of the sitter's countenance suffers, but a harsh and unnatural edginess characterizes the picture. If, on the other hand, it is allowed to be too great, the oblique pencils, which it should have corrected, interfere with the perfection of the image, and distorted forms and misty outlines are seen.—LAKE PRICE.

120. It is often necessary to know the focal length of a lens or combination of lenses, especially in photography; but if no plano-convex lens of known focal length is at hand, for the purpose of comparing the size of the image, the following way may be adopted: first, focus the lens for a very distant object, on a screen, and mark the position of the screen. Do not move the lens, but place a bright object, about twice the focus of the lens, in front of it, as near as you can suppose; now move the screen about the same distance from the lens as the object was placed, and focus thereupon. If you find the object and the image not of exactly the same size, move object and screen accordingly, and focus sharp, until the object and image are precisely the same size; mark the position of the screen again, and the distance of the first and second mark is the focal length of the lens, or the equivalent focus of a combination of lenses.—JOSEPH ZENTMAYER.

In conclusion, a few words yet about treating your lenses. Always keep them from light and dust when not in use; never drop them on the floor, and when dusty or soiled clean them carefully with a piece of old linen or old silk handkerchief. From sad experience I almost feel inclined to add to this: *Never loan them out.*—R. BENECKE.

LESSON D.

THE DARK-ROOM.

121. The dark-room for the manipulations of the plate should be convenient to the glass studio, so located that it can be thoroughly ventilated at top and floor, and kept of even temperature all the year around. It should be as large as your space will admit, say not less than twelve by fifteen feet. It should be provided with a developing sink, another for fixing, and a third, under a tap, for washing the plates thoroughly. Just enough shelving to accommodate the needful articles of use *in* the dark-room, and no more.

121. The dark-room should be, of course, in the immediate vicinity of the skylight. It should be wholly lined, floor, sides, and ceiling, with wood, and painted in oil of a light yellowish color, which allows of its being wiped off, as occasion may require, with a damp cloth. If the room happens to be papered, and the ceiling white-washed, the paper, if in good order, should be painted as above described; the ceiling must be scraped off and also painted. No projecting ledges must be permitted as deposits for dust. This room should contain absolutely nothing except what appertains immediately thereto, such as bath-holders, a shelf to stand the plate-holders, a small shelf handy to the sinks for the developers and strengthening solutions, and a small shelf to contain the plates and collodion vials. Everything else in the shape of bottles, chemicals, boxes, etc., must be banished. This room need not be larger than eight by ten feet square.

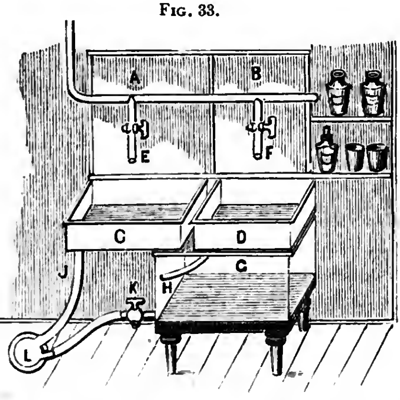
A sash about two feet square, glazed with yellow (orange-yellow) glass should be let in, immediately opposite the tank, at such an elevation that the operator, in developing, need not stoop or bend over too much. This room is never to be *swept* out, but a mop is provided, with which the room must be mopped out every morning before commencing work. The sash above alluded to must be provided with shutters or covers, that more or less light may be shut out as desired. I need scarcely add that every particle of *white light* must be carefully excluded. When such a window is impracticable, you may use either gas or a lamp, inclosed in a lantern-frame glazed with orange glass. Do not commit the too common error of having this room too dark. It should be sufficiently light for all operations without the least fumbling. The shelf containing the plate-holders should be covered with thick bibulous paper, for absorbing all drippings of silver, and for resting the edge of the plate a moment or so after its immediate extraction from the bath. Above all, do not neglect the great precaution of thorough ventilation. If possible, a trap-door should be let into the ceiling, or else the door should face the window, when a draught of air can at any time be admitted.—Elbert Anderson.

122. A cupboard for chemicals is also a good arrangement. The most rigid cleanliness should always be practised here, and "house-cleaning" of frequent occurrence. All white light should be excluded, and only that which is yellow, ruby, or orange admitted. A great convenience, not only, but a great necessity in the dark-room, is plenty of clear, pure water, and a proper arrangement of the tanks, with a means of saving such waste as is of value, and of getting rid of the rest without injury to the health. Dust in every shape and form should be most enthusiastically opposed in the dark-room. It should not be allowed to enter the door; it should not be brought in, or created by allowing the drip from your solutions to crystallize on the floor. Walk the floor gently; wipe it up vigorously with damp cloths daily.

122. THE TANKS.—The arrangement of the tanks for developing and washing may be something after the following plan:

Immediately in front of the yellow-glazed sash, A B (which should be constructed so as to raise and lower like an ordinary window), are placed two trays, C D, about two feet long by eighteen inches wide, and three inches deep. The water is admitted from a reservoir by a pipe containing two cocks, E F, which are so constructed as to give a smooth crystal bar of water without spattering. The plate is to be developed over the tank D, and well washed, both on the back as well as the front. The silver, which is perfectly precipitated by the iron in the developer, and also the excess of nitrate being washed off, flows from the tray D through the waste-pipe H into the tank G. Observe that the pipe H should be led to the *side* of the tank G, the water thus flowing against this side is prevented from stirring up the settled silver on the bottom of the tank G. The negative, after being removed from the hypo. tray (which should be in a convenient neighborhood), is drained a few minutes, and then thoroughly washed over the tray C, the water flowing through the pipe J into the general waste-pipe L. Into the tank G is inserted a stop-cock, K, four inches from the bottom of the tank; this cock is connected with the waste-pipe K by means of an india-rubber hose, which may be removed and replaced at pleasure. No further treatment is required. The precipitated silver settles quietly down during the night; the water, being quite clear above, may be drawn off every morning.

FIG. 33.

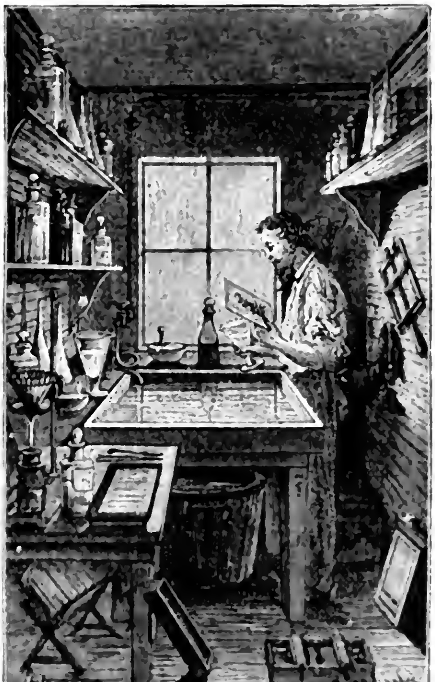


Finally, this room should be provided with a gas-stove, upon which is placed a tin of water during the winter, for maintaining a healthy and breathable atmosphere; a thermometer should be hung conveniently, and an even temperature kept up between sixty and seventy degrees Fahrenheit.—ELBERT ANDERSON.

123. As in any other work, so in the dark-room, the photographer should look well after his light supply. If the light is allowed to come into the dark-room from the side, it should be from a window sufficiently low and sufficiently forward to enable one to receive a good light underneath the plate when held for development. The drawing below supplies an admirable model, though supplied with rather more than properly belongs to the work of the dark-room.

124. REQUISITES FOR THE DARK-ROOM.—The dark-room is, or should be, the operator's pride. Hither he sends forth the wondrous mysteries which are to win him fortune and fame, and *all* depends upon his manners and manipulations therein. It should be supplied with every needful article, of the best quality, without stint, and kept everlastingly clean.

FIG. 31.



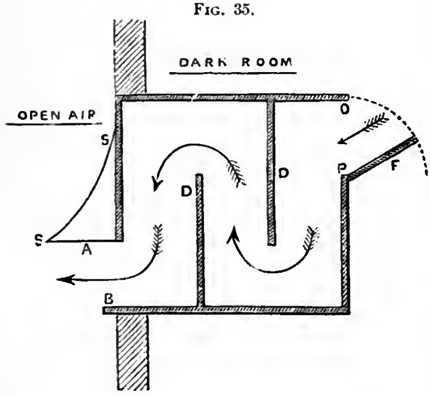
123. The dark-room should be arranged with the greatest care: in it the sensitive plates are prepared, and the various delicate processes which have to be guarded from daylight are performed. We have said that every ray of white light must be carefully excluded. It should be conveniently arranged, so that the operator has ready at hand all the things he requires while manipulating, which he has to do as quickly as possible. A narrow table is fixed to the wall for supporting the sensitizing baths, which have to be placed in a somewhat inclined position. There should be a row of shelves for holding the bottles of collodion and other chemicals. It is well to have a sink near the table, with a tap above it for washing the proofs; this tap may be advantageously fitted with a piece of india-rubber tubing, having a rose at the end, so that the water may be quickly and easily applied over a large surface.—G. TISSANDIER.

For real comfort and convenience, I like one grand, large tank for the dark-room first, in which I place all the smaller tanks, as described by Mr. Elbert Anderson in his excellent work. The real advantage of such a large tank is this: It saves the floor from the splashings of the solutions and the consequent damage done to the plates by the raising of crystals in the air by the feet, which are sure to cause pin-holes.—G. W. WALLACE.

Besides the required chemicals, we need a glass bath-holder for our sensitizing solution; a silver dipper for lowering the collodionized glass plate into the bath; pouring-bottles for collodion; developing-trays and bottles; draining-racks; graduated measures; funnels; a spirit-lamp; tanks; dishes; a goodly supply of water, and a multitude of minor useful articles, whose names and use will be explained at the proper time.

125. The ventilation of the dark-room is a matter which must be rigidly attended to. At the floor, openings a few inches high should be cut, the light kept out by inward strips, for the poisonous fumes usually work downward. A plan devised by Mr. Nelson K. Cherrill is shown by Fig. 35. It consists of a long box of any length required, with an opening (A B) all along the lower side of the front, and a similar one (O P) all along the upper side at the back. The two inward partitions (D D) are made, one extending from the bottom to within six inches from the top, the other from the top to within six inches of the bottom. The box is about eighteen inches square. The opening in front (A B) should be the same with the space left above and below D D, and also the same as the opening O P. The other spaces should be about the same, say six inches. There is a door at F; the passage of air is shown by the arrows. No light can enter. S S is intended for a zinc shade, fitted outside, to protect from the weather. Blacken the whole inside. One should be at the floor and one at the top of the dark-room, to suit all seasons. The scale of the drawing is one inch to a foot.

Fig. 35.



LESSON E.

PREPARATION OF THE GLASS.

126. Too much care cannot be given to the selection of glass for photographic use. It should be flat, clean, and free from scratches, bubbles, and rust. Fortunately, it is not difficult to find such in the market; so that about the only room there is for care, is in seeing that the plates are perfectly clean before they are coated with collodion or immersed in the bath. There are various ways of securing this—one being by the exercise of manual labor, and the other by the employment of a preliminary coating of albumen.

127. The use of the albumen substratum is now the most general. It

126. For cleaning glass and bottles, the best I have ever found is, viz.:

Saturated Solution of Bichromate of Potash,	2 ounces.
Hydrochloric Acid,	1 ounce.
Water,	5 ounces.

Let the glass or bottles remain in this twenty-four hours, or until clean; wash well, and I guarantee you will have clean glass; even old varnished negatives, or anything, it will clean them.—W. B. CRITCHFIELD.

The task of bringing glass plates to a condition of perfect cleanness is a well-recognized nuisance in photography, and anything which alleviates it will doubtless be received with satisfaction. None of the methods now in use seem to give satisfactory results without much trouble. It is otherwise with that which I am about to describe, and I think I may say that no one who tries it will ever employ any other. A convenient and large porcelain tray is to be appropriated to this purpose. In it is placed the following solution:

Sulphuric Acid,	1 ounce.
Bichromate of Potash,	1 "
Water,	1 pint,

preparing a sufficient quantity to cover as many glasses as are to be cleaned. Glasses left in this solution over night (except in very obstinate cases, which may require a little longer treatment) will generally be found to require only rinsing off, or at most a gentle rubbing, to be perfectly clean. Grease-spots, obstinate stains, remains of old collodion, and all the other troubles, lose their hold, and the task of cleaning loses almost all its trouble.—M. CAREY LEA.

127. To bring the albumen into a suitable condition, and preserve it ready for use, is the problem to be solved. This is accomplished in the simplest manner possible: Take a wide-mouth bottle of the capacity, say, of sixteen fluid ounces (provided with a well-fitting cork),

is the easiest and the surest. It is less liable to cause failure, provided fresh eggs be used and the directions given are followed. Previous to any other treatment, the plates should be roughened on the edges and corners by means of a file or by emery-paper, or by drawing the edges of the plates together. This saves the fingers from injury. Now immerse the plates in a pan of strong concentrated-lye solution, or commercial nitric acid, a couple of hours—the former if the plates are old, the latter if new—then well wash them and, while wet, flow the most concave surface with the albumen solution.

128. We are ready now to proceed with the manipulations, and, as we make the trial, let us ever remember that *care*, *coolness*, *cleanliness*, thoughtfulness, and a *sincere desire to secure good results* are of absolute importance. If one does not *want* to do a thing well, one is apt to have sorry success. Photography needs all the desire and heart you can put into it, for chemicals are obstreperous, the elements are fickle, and constant changes need that you should always be on the alert.

and into it pour the whites of a dozen fresh eggs. Take a lump of camphor gum of the size of a hickory-nut, and inclose it in a bag of thin muslin, formed by puckering the muslin together over the camphor. Tie the bag around the neck with twine, which pass through a hole (previously perforated through the centre of the cork) from the under side; draw up closely, and fasten in place by a knot above. If the albumen is to be used for the substratum of negatives, I add one or two drachms of strong ammonia. Cork the bottle, and let stand about a week, when the albumen will be ready to be used from as required. Dilute as usual. In this way a year's supply may be put up when eggs are plenty and prime. If the albumen is to be used in a preservative or organifier for dry plates, the ammonia must be omitted.—W. H. SHERMAN.

In the *Photographic Times*, September, 1875, is a receipt as follows:

Albumen,	1 ounce.
Water,	8 ounces.
Ammonia,	1½ "
Iodide of Potassium,	30 grains.
Bromide of Potassium,	15 "

Shake well, then fill up stock-bottle with water, eight ounces. *This is worth gold.* I forget the author's name.—E. T. WHITNEY.

128. For negatives, the artist needs for good work glass of ordinary strength and thickness, and free from waves and blisters. Perfection of clearness is only to be obtained in the finest plate-glass, but as it costs four or five times as much as good sheet-glass, it is but seldom used by our photographers. We know one who used it, who afterwards substituted successfully a very superior article of clear and light-colored glass, called the "Berkshire Crystal Sheet," made from the beautiful white sand of the Berkshire Hills in Massachusetts. American glass-makers have, of late years, greatly improved their quality in regard to color, clearness, good annealing, and consequent strength and toughness.—THOMAS GAFFIELD.

LESSON F.

CHEMICALS AND SOLUTIONS.

129. THE COLLODION.—Collodion is a mixture of alcohol, ether, pyroxylin or gun-cotton, and sundry iodides and bromides, which are sometimes called "salts." When of proper consistency it is of the thickness of cream, and of a rich straw color. Spread upon the photographic plate, it serves to retain the sensitizing agent while subjected to the light, and to unite with it in forming the film from which the photographic image is developed. It is made as follows:

Ether,	10 ounces.
Alcohol,	10 "
Iodide of Ammonium,	50 grains.
Bromide of Potassium,	20 "

130. In hot weather cadmium-bromide may be used in place of potas-

129. The following modification is good:

Ether,	6 ounces.
Some Brains,	
Alcohol,	6 "
Some more Brains,	
Cotton,	72 grains.
Some Iodide, and a little more Brains,	
Some Bromides, and a large quantity of Brains.	

After the above is all dissolved and settled, add enough brains to make a good negative.—HUGH O'NEIL.

Having made a number of trials with a view of determining what is the best strength for salting the collodion, and what the best for the bath, I have arrived at the conclusion that an increase in the sensitiveness is obtained when the collodion contains thirteen grains of iodides and bromides, and the bath is reduced to twenty-eight grains per ounce.—ELBERT ANDERSON.

130. Collodion for hot weather.—

Ether,	10 ounces.
Alcohol,	12 "
Bromide of Cadmium,	1 grain per oz.
Bromide of Ammonium,	1 " "
Iodide of Cadmium,	1½ " "
Iodide of Ammonium,	3 " "

Add to the ether and alcohol, and shake until all is dissolved, filter, and add your cotton A reasonable amount of age helps this collodion.—HUGH O'NEIL.

sium. It improves the keeping qualities of the collodion, but it cannot be used so soon after making it. A potassium collodion may be used a few hours after it is mixed. After weighing out the ingredients, we put the alcohol in a bottle, and add the iodide; after the latter is dissolved add the ether. The potassium must be dissolved in water, as little as possible being used, and then added to the other. A precipitate is at once formed, the bromide entering the collodion and the metal base falling to the bottom. This we filter out by means of filtering-paper, and then add sixty grains of gun-cotton to the whole. After settling a few hours, and filtration through a tuft of clean absorbent cotton, the collodion is ready for use in coating the sensitized plates.

131. If the novice is not aware of the fact, one day he *will* be, that photographers are an exceedingly dogmatic species. They will stickle

131. For collodion, the best chemicals should be used. Ether and alcohol equal parts. For thirty-five ounces, use

Iodide of Cadmium,	135 grains.
Iodide of Potassium,	70 "
Bromide of Cadmium,	70 "
Iodide of Ammonium,	12 "

This I use in winter; for summer it is not limpid enough, cadmium making it tend to fogginess. I have another collodion.

Alcohol,	12 ounces.
Ether,	8 "
Iodide of Ammonium,	5 grs. per oz.
Iodide of Cadmium,	1 gr. "
Bromide of Cadmium,	2 grs. "

Take two parts of the first and one part of the last. This makes a combination that will work in the hottest of the season. The last collodion is fine for copies. Developer is twenty grains; solution of iron in water, acetic acid, little.—S. M. Robinson.

The following suggestions for modifying the tendencies of collodion will be found useful, both in relation to commercial samples and to making others. For subjects having violent contrasts, and for instantaneous collodion, a large proportion of bromide may be used to secure softness and harmony. The tendency of bromides is to decrease contrasts and secure detail. When the contrasts are great, and there is a tendency to hardness and over-intensity, the amount of bromide may be increased; when want of intensity is present, the proportion of bromide may be decreased. A quarter of a grain, or less, per ounce, will secure cleanness.

Collodion yielding a thick, creamy film generally gives a vigorous, fine image. The addition of an extra grain or two of pyroxylin will often confer this quality on collodion giving a thin image, as the use of a good body of pyroxylin tends to give a dense image. When the film repels the bath, and gives a thin image, a drop or two of distilled water to the ounce will often be an improvement, if the defect proceeds from the use of anhydrous

for a favorite salt, or an extra grain thereof in their collodion, with as much tenacity as Shylock did for his "pound of flesh." Some use the bromides only. Some others modify their formula "to secure more intensity," or "a better color," or what not. Oftentimes there is reason for these modifications, and it is as well to understand them, though, since light and atmospheric changes rule the matter largely, experience is the best teacher.

132. A "slow" collodion, and one giving flat effects without brilliancy and roundness, is not difficult to produce, hence effort is made to secure such a mixture of the ingredients as will enable the operator to work quickly and at the same time get the proper printing density. Perhaps as many varieties of formulæ could be given as would fill this book—one or two will suffice, though a great many *know* that they are by no means the best. They have been found sufficient, however, to avoid the necessity of procuring a "lightning" rod.

133. Among others, the veteran photographer, Mr. J. W. Black, of Boston, advocates a collodion entirely without bromides. This necessitates the working of an extremely acid bath, and, as that is difficult,

[illegible]vents. Over-iodized collodion generally produces streaks at one end of the plate, and, if the iodide be present in great excess, it leaves the film in flakes whilst in the nitrate bath.—G. WHARTON SIMPSON.

[illegible] I will give one of the quickest and finest collodions in existence:

Alcohol and Ether, ...	equal parts.
Iodide of Potassium, ...	5 grains.
Bromide of Potassium, ...	2½ "
Pyroxylin (to ounce of plain collodion), ...	5 to 6 grains.

Now it is the way this is made that makes the difference. Weigh out the excitant and the cotton, and put them into the ether and alcohol, and shake the bottle until the whole bath is dissolved; let it stand until it settles; then filter, and you have it.—JAMES O. MERRILL.

133. With regard to the preference of the bromo-iodized collodion over the purely iodized collodion, it is found practically in the greater sensibility of the former for the reflected light of the shadows. Having stated the difference of quality of the direct and reflected light, the following will be easily understood. A plate of purely iodized collodion is sensitive only for violet and violet-blue rays, purely bromized collodion is sensitive for violet, violet-blue, and blue rays, bromo-iodized collodion is sensitive for violet, violet-blue, blue, and even green rays. The decomposition of the white light into the pure colors which nature shows in the rainbow can be effected by a prism of glass. By photographing the rainbow-like colored spectrum, which is obtained by the prism, these remarkable facts have been stated.

It is obvious, therefore, that the bromo-iodized collodion is the most susceptible to impression by the light of the shadowy parts, in which the violet and violet-blue rays are much

and since the most lovely effects can be and are secured with the bromo-iodized collodion, there is no good reason for going into trouble for the sake of avoiding its use. Yet, as long as the collodion and the nitrate bath are used, doctors will greatly disagree on this point.

134. "Double-iodized" collodion is preferred by some manipulators. It was introduced commercially some years ago by Mr. Alfred L. Hance, of Philadelphia, and his brand is yet very popular in some sections Its preparation is about as follows:

Iodide of Potassium,	166 grains.
Iodide of Cadmium,	183 "

Dissolve in as little water as possible, and evaporate by heat to dryness, stirring constantly. To each ounce of plain collodion add

Double Salts,	6 grains.
Bromide of Cadmium,	2½ "

In making up the plain collodion the quantity of alcohol per gallon should be about eight ounces short, and when the iodizing solution is

weakened, as it is sensitive also for blue and green rays, while with purely iodized collodion this sensibility is wanting.—SHULTZ SELLACK.

INTENSE COLLODION.—As a means of obtaining density in negatives, it has been recommended to introduce into the collodion organic matter in the shape of sugar. Dissolve one grain of *white* sugar in a few drops of water, add this solution to the alcohol in making the collodion; one grain of sugar being sufficient for four ounces of collodion, and causing it to yield negatives of the utmost intensity. The introduction of too much sugar renders the film rotten, and in some cases it will be found desirable to reduce the amount here given.—J. L. GIHON.

134. It was in the year 1857, I believe, that I first made use of the iodides of potassium and cadmium in combination. I have, in connection with this double iodide, used the double bromides of cadmium and ammonium in the manner to be described, to prepare the double iodide and bromide, which is simple and easy to do, and leaves you with but two salts to weigh out when compounding your collodion. The potassium-cadmium iodide is prepared thus:

Potassium-Iodide,	332 parts.
Cadmium-Iodide,	366 "

Dissolve together in as small a quantity of distilled water as will dissolve them; evaporate by a gentle heat to dryness; stir at the last with a glass rod to granulate the salts. When quite dry, bottle for use. Ammonium-cadmium bromide in the following proportions:

Ammonium-Bromide,	196 parts.
Cadmium-Bromide,	272 "

Dissolve and prepare same as the iodide. I now prepare two collodions, one iodized, the other bromized, enabling one to mix the collodions to suit any subject desired.

Iodized collodion, made with equal parts ether and alcohol, cotton to suit, and with six grains of iodide to the ounce.

added as below, the quantity will be correct. For one pound of collodion take

Double Iodide,	96 grains.
Bromide of Cadmium,	40 "
Alcohol,	1 ounce.

Careful watching is needed in evaporating the salts to complete crystallization.

135. Both the quality and the quantity of cotton used in the mixture of collodion are to be regarded. Our American manufactures run very uniform in quality as a usual thing, and once you find out a sample that

Bromized collodion, made with five parts ether to three parts alcohol, cotton to suit, and ten grains bromide to the ounce.

Mixed in the following proportion, this collodion will be found to meet the wants of both landscape and portrait photography.

Two parts iodized to one part bromized; suitable for dry plates, and used wet, for interiors and dimly lighted subjects.

Three parts iodized to one part bromized; suited for children and quick exposures.

Four parts iodized to one part bromized; a generally useful collodion.

Five parts iodized to one part bromized; suited for copying and subjects presenting little contrast.

The nitrate bath should be sufficiently acid with nitric acid to immediately change blue litmus-paper, for the collodion has the property of neutralizing the bath. It is better *not* to use this collodion till it is one to three months old. Yet it can be brought into working condition in as many days by the addition of tincture of iodine; but I would recommend those who desire to try it, to bottle it up and lay it away in a cool place for a few months, for, like good wine, it improves with age.—John Carbutt.

There is no difficulty in preparing the double salts. To produce double ammoniun-cadmium iodide, dissolve one hundred and forty-five parts iodide ammonium and one hundred and eighty-three parts iodide cadmium in water, and evaporate till it crystallizes. It crystallizes quite easily in slightly distorted cubes, and can be freed from the yellow mother lye by pressing. If you wish very clean salt, you will have to crystallize it again.

The single ammonium-cadmium bromide is prepared by dissolving three hundred and forty-four parts of crystallized bromide-cadmium and ninety-eight parts bromide ammonium in water, evaporating till crystallization; the latter may also be repeated.—Dr. H. W. Vogel.

135. When we increase the quantity of cotton in a collodion, the sensitiveness of the preparation increases also. Dr. Zettnow recommends to use as much cotton as possible, but practically we soon reach a limit, as thick collodion does not flow readily; to this must be added, that if the proportion of collodion is increased beyond two and a quarter per cent., a decrease of sensitiveness takes place instead of an increase. The high-lights, of course, become more intense with a thick collodion, but the shadows are paler and the picture looks hard. The boundary-line to which we may go in increasing the thickness of collodion depends on the nature of the pyroxylin employed; of a short-fibred cotton a larger quantity may be taken than of a long-fibred variety. Dr. Zettnow maintains that the beauty of a

pleases your fancy, you will have but little trouble to secure it again. The action of the acids used in the manufacture of gun-cotton, with some samples of the raw cotton, produce such foreign bodies as gum, glucose, etc., but as a rule, they cause no injury. As to the quantity of gun-cotton to be used in collodion, there can be no real rule, but the formulæ given are enough to guide one.

136. THE SENSITIZER.—To render the collodion film sensitive to the light, it must be immersed in a solution formed of nitrate of silver crystals, and water. The water must be pure, and the silver free from contamination, used in the following proportions:

Water, ...	36 ounces.
Nitrate of Silver, ...	3 "

After the crystals are dissolved, add to the solution two grains of iodide of potassium to each ounce of silver used, first dissolving it in a few drops of water, or, what is better, make a solution of iodide of silver, and add it. The iodide mixes with the solution and the potassium is precipitated. Filtration follows, when a few drops of chemically pure nitric acid are added, drop by drop until blue litmus-paper is slowly turned red by it. This solution is usually called the "bath," or sensitizing solution. Placed in the glass bath-holder, it is ready for use.

picture increases with the amount of pyroxylin contained in the collodion; this, however, is a matter of taste: a thick collodion gives stronger contrasts, *i. e.*, the shadows are thinner and the lights more intense, but a limpid collodion will yield a softer picture, provided the time of exposure has been sufficiently long. When the contrasts of light and shade are very strong, as in a sunlit landscape, I prefer taking a thin collodion, and by lengthening the time of exposure I obtain a softer picture.—DR. H. W. VOGEL.

136. Most collodions require a faint acidity of the bath, but the utmost care is requisite to avoid adding too much. Putting a glass rod into a nitric-acid bottle, and stirring the bath with it, as some do, is a most clumsy way, and introduces a great deal too much—several drops at once. The best way is as follows: put four ounces of distilled water into a stoppered vial, and drop into it sixty-four drops of pure nitric acid. Each half drachm will then contain exactly one drop of the acid. When you mix your bath with the crystallized nitrate, you may find your collodion work well with it at once. But where fused nitrate is used, acidification is apt to be required. To a twenty-five ounce bath, add a half drachm of the dilute acid, that is, one drop of nitric acid, and try a plate. If it fogs, add another drop and try again. In the last trial which I made, a twenty-ounce bath of fused nitrate required just two and a half drops of nitric acid to make it work right.—M. CAREY LEA.

TO MAKE IODIDE OF SILVER.—Take twenty grains iodide of potassium, and dissolve in one ounce of water; twenty-five grains of nitrate of silver, and dissolve in one ounce of water. A precipitate is formed, which is iodide of silver; wash the precipitate six or eight times and it is ready for use.—HUGH O'NEIL.

137. No witch of the Vesuvian Caves ever exercised more diligent care in the preparation of her potent philtres than should the photographer in the preparation of his bath solution. And moreover he should be generous about it. It is not enough to merely have solution sufficient to cover the plate. It should not be expected to bring you good results without a plentiful supply of that which renders it capable. Therefore, a good large solution is recommended, and is indeed necessary, if the best results and least trouble are an object. And more than this: Do not trust to a single solution, for, like your health, it is liable to break down at any and the most unexpected moment. Therefore, always have a second solution in good condition ready for any emergency. This will relieve you from anxiety, and it will save you from many a mortifying failure. Indeed, there is a great deal of "human nature" in a bath solution.

137. To make a *good* bath buy a *pound* of silver. Do not let this startle you, for in a year's time you no doubt buy much more; buy a pound of silver, I say, at once; that is your first step. Oh, that I could impress it upon your mind not to be niggardly in the matter of silver! Dissolve the aforesaid pound of silver in one hundred and sixty ounces of the purest water you can find. Sun the same well, and filter enough into your bath-dish for use; into this drop enough nitric acid, C. P., to redden litmus-paper a trifle. Coat a glass plate well with collodion, and leave in your bath (which latter is perhaps a sixteen-ounce one) over night; then go ahead with your sitters until you begin to perceive that the bath fails to give the good results it did in the beginning, from the introduction of ether and alcohol and iodides; then *filter* it back into the large bottle of solution, which I take for granted has been sunning, and that you are clean about your fingers in the dark-room generally. Out of your stock solution you may now fill up your bath-dish again, acidifying and iodizing should it need it.

Your first bath should dip at least fifty plates before needing renewing, and your next the same. When in turn this bath fails, proceed as you did with the first one, viz.: filter it back into the stock solution, and fill up your bath-dish again out of the same, this time and ever afterwards omitting the acidifying and iodizing. Proceed in this manner, using the solution over and over again, until from continued use the whole bath becomes charged with alcohol and iodides.

At this stage you will find that you have on hand a little over one hundred ounces of solution, testing about forty grains per ounce. I would then advise the following treatment: Heat the solution until at least one-half the water is evaporated, then while still hot drop carefully, a little at a time, ammonia into it until red litmus-paper is turned blue by the same; immediately set in the sun, when all the impure matter will be precipitated, and may on the solutions cooling be filtered out. You have then a solution on hand about eighty grains strong, slightly alkaline. To this may be added pure water to bring it up to its former strength. You may now add to the same four ounces of silver and forty ounces of pure water, and you have a bath which, after acidifying, will work for the next six months better than an entirely new one.—C. A. ZIMMERMAN.

138. The desire for greater rapidity has been one largely in the minds of photographers always. This is all right enough, so long as good qualities and necessary ones in the negative are not sacrificed. Sometimes they are. During the past two or three years, many "quick" processes have been published, but in result they are never superior, and often inferior, to what is obtained by the usual photographer by ordinary means. It is an acceptable thing to the sitter to be released a few seconds sooner from the grip of the head-tongs, but it is no honor to the artist if his results are spoiled.

138. To ninety-six ounces of pure water add eight ounces of nitrate of silver, forty grains of iodide of potassium, and two hundred and eighty-eight grains of nitrate of baryta. Shake until the whole is dissolved. Now filter thoroughly through two thicknesses of filter-paper; filter several times until the milkiness has all disappeared, then make sufficiently acid with C. P. nitric acid. Any good developer will do, but I make mine in this way:

Pure Crystals of Iron, ...	10 ounces.
Granulated White Sugar, ...	6 "
Water, ...	32 "
Acetic Acid, ...	3 "

Of this stock solution take three ounces, and add twelve ounces of water and one ounce of acetic acid.

I have been able to make pictures of infants in one second, that were full-timed negatives, and averaged sittings in from three to six seconds.—E. P. Libby.

Rapid negative bath:

Nitrate of Silver, ...	35 grains.
Boric Acid, ...	4 "
Water, ...	1 ounce.
Iodide of Potassium, *quantum sufficit.*	

A few drops of nitric acid, sufficient to render the bath slightly acid. Developer:

Sulphate of Iron, ...	29 grains.
Acetic Acid, ...	20 drops.
Acetate of Lead (Sugar of Lead), ...	3 grains.
Water, ...	1 ounce.

Put a filter in a clean funnel, and fill it a quarter full with boric acid, filter the developer always through it; the solution will take up the necessary quantity of boric acid; the filter and boric acid will last a very long time.—Alexander Henderson.

For extra rapid work try the following:

Nitrate of Silver, ...	8 ounces.
Iodide of Sodium, ...	40 grains.
Nitrate of Baryta, ...	288 "
Distilled Water, ...	96 ounces.

Conrad Peterson.

I do not believe in this "lightning" business. I can produce as "quick" results as any of you with my ordinary solutions.—Old Argentum.

139. THE DEVELOPER.—The collodion may flow never so smoothly, and the nitrate solution prove ever so sensitive, yet they are powerless to produce results, unless a third solution known as the developer be employed. It startles the latent image from its slumbers within the film, as the sunshine startles the morning and develops it into "the perfect day." The development of a photographic plate is probably the most beautiful operation in chemistry or physics. Once the developer strikes the exposed film, armies of molecules are started into action, and move in solid phalanxes as well as in tiny squads, with one intent, to build up the grand result. To make the developer, have a stock-bottle containing

Water,	64 ounces.
Protosulphate of Iron,	4 "

From this separate fourteen ounces, and add thereto two ounces of acetic acid. Shake well.

I wish here to confine myself to showing how a rapid negative bath may be made that will keep in working order for an indefinite period, with only the usual strengthening and occasional boiling to get rid of the ether and alcohol. Formula for bath:

Nitrate of Silver,	2½ ounces.
Common Water,	30 "
Nitrate of Barytes,	90 grains.
Iodide of Potassium,	20 "
Nitric Acid,	Enough to show slight acidity.

Filter, and the bath is ready for use.

The filtering-paper containing the undissolved iodide of silver must not be thrown away, but used every time the bath is filtered. To obtain the full effects of this bath, it is necessary to have an excess of iodide of silver. When the bath requires strengthening, add three grains of barytes to each ounce of solution in addition to the nitrate of silver, otherwise it would be difficult to estimate the strength of silver in the bath. By the argentometer this bath will register about thirty-five degrees. Any collodion will do; it must not be too horny. —W. E. DEBENHAM.

139. DEVELOPMENT.—Photographers who aim at good work, and at ease in getting through it, are recommended to use a saturated solution of iron for their developer. It saves a great deal of time in making up solutions, and a great deal of trouble in weighing, shaking, etc., and the strength of the developer can be altered at pleasure to suit the particular subject in hand. To use it, take

Saturated Solution of Iron,	1½ ounce.
Glacial Acetic Acid,	6 drachms.
Water,	18 ounces.

This gives a fifteen-grain developer. To make a twenty-grain developer, take

Saturated Solution of Iron,	2 ounces.
Glacial Acetic Acid,	6 drachms.
Water,	18 ounces.

W. T. WILKINSON.

140. It will be seen that there is diversity of opinion here also. The real fact is development, like exposure, is a matter of inspiration or of feeling. It is the department of manipulation above all others which requires the most careful watching, the most attentive thinking, and the clearest-headed handling. It is the file by means of which all the roughness of previous manipulations may be smoothed down and modified tolerably, if the head and hand help it. The simile is a mechanical one, but proper development is an art, or mayhap, a science.

I like the following:

Protosulphate of Iron,	2 drachms.
Common Alum,	4 "
Acetic Acid,	2 "
Gum Camphor, broken up in small pieces in a bottle of water,	6 ounces.

If the bath be stronger or weaker than thirty grains, the alum must be increased or decreased in the same ratio.—A. L. HENDERSON.

We want to produce a negative brilliant in contrast, transparent, and solid. First, let us make a developer.

Iron,	2 parts.
Epsom Salts,	1 part.
Acetic Acid,	1 "

Hydrometrical test—Iron, fifteen grains.

This I consider the most perfect combination for a developer, as the astringent Epsom salts reduce softly. Then there must be the proper amount of acid in the iron to insure a slow and continued deposit. Of course, a continued deposit depends mainly upon the condition of the bath, which must not be too acid.—S. P. WELLS.

140. I offer a method of modifying the plain iron developer which shall produce any desired effect in ordinary gallery work, both positive and negative, and which will be found, for cheapness and convenience the best thing out.

The basis of stock solution of this developer is that used by a majority of photographers, viz.:

Water,	64 ounces,	fluid.
Protosulphate of Iron,	4 "	by weight.
Acetic Acid, No. 8,	4 "	fluid.

If the silver solution has been in use for a length of time, it will be necessary to add from one to four ounces of alcohol to the above, which is to counteract the effect of the alcohol and ether, which may have accumulated in the silver solution from the collodionized plates.

The process of development by this solution should be carried on over a large glass funnel, which should receive all the solution which runs off the plate and the draining of the plate after development. This surplus or wash should pass through a loose filter into a receptacle below, and saved to be used again in the proportions of two-thirds of old to one-third new for positives, and for negatives in proportions to suit the purpose, but usually a greater proportion of the new to the old.

141. For delicate effects, preference is often given to the ammonio-sulphate of iron developer. If your subject is dressed in white draperies, or is himself fair-skinned and fair-haired, this form will be found of service to you. Make it as follows:

Double Sulphate of Iron and Ammonia, ...	$2\frac{1}{2}$	ounces.
Acetic Acid, No. 8, ...	5	"
Water, ...	40	"

Apply with the same care as the other.

Now by the above method any desired effect can be secured both in negatives and in positives, and it only requires a short experience by an observing operator to determine the proper proportions. It will also be observed that this formula, or rather method of development, has the great advantage of economy, reducing the expense of material for developing solution one-half ordinarily, in very few instances more or less, as the work may be in positives or negatives.

In the development of a negative, if it is desired to obtain a very soft effect with fine definition, increase the quantity of new solution up to the exclusion of the old, as the case may be; to secure intensity, the proportion of old may be increased. It will at once be seen what a range of modifications is here obtained, and what great advantages may accrue from so simple a device.—E. M. ESTABROOKE.

141. My preference has always been for the ammonio-sulphate of iron developer. Make a saturated solution of ammonio-sulphate of iron in water, filter, and to every ounce of solution add one drachm of glacial acetic acid. This is a stock-bottle, and by making six or eight ounces, it will be sufficient for a large number of plates, and has the advantage of keeping any length of time in good condition. Before developing a plate, it is necessary to reduce the strength of the saturated solution. Take a small wide-mouthed bottle, and to every five drachms of water add two drachms of the stock solution. The developer is now ready for use. Time may be saved by marking with a file or diamond upon the bottle the exact amount of water desired, and another mark for the iron solution. The proportion of five to two is the formula that I generally prefer, but it can readily be altered to suit the subject by increasing or decreasing the amount of iron. When the bath is new no difficulty will be experienced in flowing the developer evenly over the plate, but by constant use, alcohol and ether being absorbed into it, the developer may require the addition of a little alcohol to make the solution run perfectly even. After standing for some hours a crystallization will take place in the bottom of the bottle, but that is to be expected, and will do no harm to the solution. I have had no experience with this developer for portraits.

Negatives developed by this double salt are peculiarly suited for making glass positives for the magic lantern, also for solar enlargement. Indeed, for every purpose that I have used it (except instantaneous photography), perfect satisfaction has been given. The concentrated character of this developer makes it well suited for out-door work, where every pound of additional weight is to be avoided by the operator. It is, of course, necessary to use as pure water as can be readily found for diluting the strength of the developer. Water containing chlorides in considerable proportions must be avoided. The time of exposure requires to be rather longer when this developer is used.—J. C. BROWNE.

142. THE FIXING SOLUTION.—Still, the beautiful, delicate image which the developer brings forth would be fugitive, and disappear when exposed to the light, were not a fourth solution appealed to to *fix* it. This may be a saturated solution of hyposulphite of soda in water, or of cyanide of potassium, say one ounce to six ounces of water. The last is a deadly poison, and should never be used. The "hypo." solution should be changed frequently to avoid the creation of pin-holes upon the plates. The old, used solution contains considerable silver, and should be saved and sent to the refiner for reduction.

143. THE INTENSIFIER.—We now have the four prime solutions or mixtures with which to make negatives; but as variations in light, temperature, atmosphere, and subject cause the chemicals to vary in their action, we must provide us with a further mixture to meet emergencies. This we call the intensifier. If, from over-exposure or any other cause, there is insufficient contrast between the lights and shades, the printing quality

142. This matter of the principle on which the fixing capacity of the hyposulphite depends is one that is scarcely as generally understood as it should be. Be this as it may, its importance would justify any amount of repetition. Photographers are perhaps too often disposed to think that, from a given quantity of hypo., they have a right to exact a given amount of work, no matter when they happen to be ready to require its performance, forgetting that a fixing bath begins to change from the first moment of its use, and continues to do so until gradually its silver is finally precipitated as black sulphide of silver.—M. CAREY LEA.

143. When a negative properly exposed is developed, and all the details are properly rendered, we have a picture in which there is a complete scale of light and shade. That it is too feeble to print does not affect this principle. But, as soon as we begin to intensify this, we increase the amount of the lights, leaving the darks of the picture unaltered. We thus entirely alter the scale of light and shade, and often make what would have been a quiet, harmonious negative, a harsh and discordant one. One of our great defects is that we treat all faces and subjects alike. If the face is finely moulded and will bear being brought into high relief, we can well bring it up into strong light; but it would often be better to keep it in low half-tint. This is now being done much more frequently than heretofore, and we can only hope that the practice may be extended to our ordinary work.—J. C. LEAKE.

I do not, as a general thing, believe in intensification, but we all get caught up sometimes, and are compelled to resort to it. Take a saturated solution of bichloride of mercury, add to it a saturated solution of iodide of potassium until all the iodide of mercury is taken up, and the solution is clear again; use two or three drops of this in one ounce of water for intensifying. Should a negative become too intense, it may be reduced again by a weak solution of cyanide. No abrupt chalky lights result from the use of this intensifier, and it will bring out wondrous detail in the shadows hardly suspected before. Wash well, and do not make the negative any more intense than you desire to have it after varnishing, as the varnish will reduce it but very little.—R. BENECKE.

of a negative may be improved by intensification. After the first, or iron development, wash the negative thoroughly all over, and then flow it once or twice with the following solution:

Pyrogallic Acid,	20 grains.
Citric Acid,	20 "
Water,	10 to 15 ounces.

Allow it to remain a moment or two upon the plate, and then drain it back into the vessel whence it came. From your bath-holder dip a small quantity of solution and double its bulk with water. Of this add a few drops to the once used intensifier, and pour the whole over the plate again and again, until the desired intensity is obtained. It should be the aim of every photographer to obtain sufficient strength in his negatives without intensification, the latter being a sort of a manipulatory intemperance, and an evil habit.

144. "The best method of intensification is not to intensify at all," is a maxim held to be true by many. The great trouble about it all is that

144. First solution.—

Sulphate of Copper,	400 grains.
Bromide of Ammonium,	10 "
Water,	20 ounces.

Second solution.—

Schlippe's Salts,	5 to 10 grains.
Water,	1 ounce.

JOHN CARBUTT.

Take a few grains of iodide of potassium, and dissolve in a few ounces of water; then add a solution of bichloride of mercury, which will at once form a red precipitate; add mercury (a few drops at a time) until the precipitate is all taken up, or until the solution becomes clear after a good shake.—HUGH O'NEIL.

Sulphuret of potassium may be also used in solution as an intensifier.

A friend of mine, the other day, gave me a good point (which I think worth noting) in the use of sulphuret of potassium; it was to *use it hot;* and it is really surprising what a wonderful printing-power can be obtained by this method when occasion requires it.—A. M. DE SILVA.

Referring to the use of pyrogallic acid for intensifying or strengthening negatives after development with iron, I stated that I had always found that the very best class of negatives of a beautiful non-actinic color were obtained by slightly intensifying, either before or after fixing, by means of pyrogallic acid in combination with acetic acid. The following formula, which I have used for many years, may always be depended upon to produce good results:

Pyrogallic Acid,	45 grains.
Citric Acid,	10 "
Glacial Acetic Acid,	1 ounce.
Water (distilled),	20 ounces.

The above solution should be poured over the washed plate, and then returned to the de-

the photographer soon learns to *depend* on this questionable power, and neglects to take the care with his previous manipulations that he should. Thus it tends to make the careless more careless. It should only be resorted to as a sort of a resuscitation in case of accident, and not habitually. With the hope that they will not be abused, the usual methods are given in the notes below.

145. As portrait photography is the branch of the art now chiefly under consideration, formulæ for securing much greater intensity than any of these will be deferred until further on in this work. There are

veloping-cup, and, after adding a few drops of a fifteen-grain solution of pure nitrate of silver, again applied to the plate. If the latter has received the right exposure, full printing density is very quickly obtained; if, however, the plate has apparently been much under-exposed, the pyrogallic solution of the above strength will probably act too energetically on the dense parts of the negative, leaving bare glass in the shadows, and producing a hard negative with too much contrast. In order to remedy this, and obtain more detail and softness in the negative, it will be found an excellent plan to avoid forcing in the first development, and to increase the strength of the redeveloping solution by the addition of dry pyrogallic acid; the latter may be added to the extent of ten to fifteen grains to the ounce of solution. This addition has the effect of curiously changing or modifying the effect of the redeveloper, which seems to lose the power of piling up the deposit on the high-lights, and acquires the faculty of bringing out the detail in the shadows to an extraordinary extent.—B. J. EDWARDS.

Instead of pyrogallic acid solution, I have, for some time past, at the suggestion of Dr. Vogel, employed the ordinary developer for the purpose of intensifying negatives. This is prepared of

Sulphate of Iron,	50	grammes.
Glacial Acetic Acid,	30	"
Water,	1000	"

Or, instead of the above amount of sulphate, seventy grammes of the double sulphate of iron and ammonia may be used.

The silver solution, used in equal proportion with the above, consists of

Nitrate of Silver,	20	grammes.
Citric Acid,	30	"
Water,	1000	"

K. SCHWIER.

145. Very closely allied with this is the consideration of what is the best means of giving that reinforcement to the negative which is sometimes necessary to furnish full printing power. I have before laid down the axiom that, given collodion, bath, developer, light, and operator, all of the best, the negative will possess, at the first intention, the proper printing qualities, with merely addition, and often not even that, of a drop of silver to the developer; but in practice, we all know, you cannot always have this combination of excellences, and then the negative, not possessing sufficient intensity, reinforcement becomes desirable; and the object of this part of my note is to point out once again the importance of letting this be the result of coloration rather than piling up by silver. A negative having its printing

times, of course, when all these will have to be resorted to in order to save a negative which cannot be replaced. But, as a rule, the exposure should be so carefully timed as not to require any reinforcing of the negative whatever.

146. There are times, too, when, by under-exposure or unavoidable circumstances of light, the negative is too dense and harsh, thus producing not only results harsh and hard in tone and color, but producing them with a slow unwillingness exasperating to the printer. It is well,

power by the first development, or by coloration, looks, when varnished, as smooth and bright as the glass itself; whilst intensification by silver causes it to have a clouded appearance, partly smooth and partly rough.

Mr. Lacy employed the solution of iodide of potassium and bichloride of mercury, poured on and off alternately, and his pictures have been equalled by very few; but, unluckily, a change takes place in negatives thus intensified by the light, and the negative gradually loses its details and becomes flat and poor. But a far better effect is produced, and no after change takes place, when a solution of the two in combination is employed. Prepare it thus: Take a saturated solution of bichloride of mercury, and add a ten-grain solution of iodide of potassium. A dense vermilion precipitate of iodide of mercury is seen, and the potassium is to be added carefully until this precipitate is exactly redissolved. This is very important. If too much potassium is present, this negative has a yellow tinge given, which is liable to change under solar influence; but with the exact quantity of each a very rich printing color is given. It may be kept in a dropping-bottle, and about ten drops in an ounce of water will do a dozen half-plate negatives. A peculiarly valuable printing quality is given by this means, and the increase is so gradual that special parts are readily brought to higher intensity or less, as desired.—SAMUEL FRY.

My practice, for many years past, has been to so manage my light that I had no occasion to intensify the negative, for I have long held an opinion that the most perfect results could only be obtained from a negative on which no deposit of silver, other than that which came in the ordinary course of development, was permitted to take place. It has frequently happened that, in consequence, I have created difficulties for myself which a little denser deposit of silver on the negative would have entirely removed. The results, on the whole, have been so much more to my taste, and the difficulties so easily removed by an intelligent management of the paper in printing, that I have been well content to go on in the same way. Of course, it would be quite impossible, except at the present time of year, to employ a bath of one hundred grains per ounce, and get from the negatives I have indicated the best proof possible; for though the deposit is comparatively thin on the negative, the contrast of light and shade is greater than that formed in the generality of negatives now produced. Over-exposure would be fatal to my method of working.—VALENTINE BLANCHARD.

146. A secondary exposure of the sensitive plate to light before development, I also find, will enable me to make a passable picture where the exposure in the camera has been unavoidably too short. To effect this, I prefer opening the shutter of the dark-slide within about three feet of an ordinary fishtail burner which I have fixed in the dark-room; a few seconds' exposure will cause a slight fogging of the negative, which, in the case of a subject presenting strong contrasts, will cause the resulting prints to appear softer and more pleas-

therefore, to have a means at hand for correcting this evil also. Various methods of doing it are given further on, to which refer in time of need.

147. VARNISH.—To protect the delicate film from injury while printing, the negative must be varnished with something like the following:

Alcohol,	28 ounces.
Gum Camphor,	½ ounce.
Oil of Lavender,	½ "
Brown Shellac Gum,	2 ounces.
Gum Sandarac,	2 drachms.

These ingredients are placed, in a bottle, in a vessel of hot water over the fire, until the gums are dissolved. Occasional stirring should be given, and finally the whole filtered before use. Before the varnish is applied, the last trace of the fixing solution must be washed from the film.

ing. Of course care and judgment must be used throughout, and the intensifying of the negative must be done with due discretion. As the gaslight is practically a fixed quantity, after a few trials it is easy to cause just the amount of fogging necessary for removing the hard, bare patches in an otherwise good negative.—ALFRED HUGHES.

A method of reducing the strength of negatives proposed by Mr. Letalle promises to be of much value for other purposes than a mere reduction of an over-dense negative, the process being one that may be termed suggestive. He operates as follows in the case of pictures that have been under-exposed and over-developed so as to force out the shadows: The negative, after having undergone all the ordinary operations, is cleaned and washed, remarking the want of harmony or too much opacity. He pours upon it *quant. suff.* of a solution of fifteen grains of chloride of gold in one pint of water. This is poured alternately from the negative into a glass, and from the glass on to the negative till the picture is properly darkened. He then washes and pours on a corner of the negative sufficient nitric acid to cover it. The whole of the silver of the negative is dissolved instantly, and the picture appears to be totally gone. On washing it carefully there is left in the texture of the collodion, however, an image, exceedingly delicate, of reduced gold. This picture can be intensified with the greatest facility by means of sulphate of iron, in the first instance, the picture coming forth with the greatest transparency, the mezzotint more intense, and the high-lights remaining transparent; or by means of pyrogallic acid, in the second instance, the primitive connection between the mezzotint and the high-lights being the same, and the advantage in this case lying in the ability to check the reinforcement on this side of the first, carried on too much. The golden, delicate picture which remains after the use of the nitric acid seems very excellent for enlargements by the solar camera, on account of its great transparency and delicacy.—J. TRAILL TAYLOR.

147. CASTOR-OIL IN NEGATIVE VARNISH.—Varnish made after the following formula will never check nor split on the negative.

Alcohol,	2 quarts.
White Lac,	12 ounces.
Gum Sandarac,	1½ "

Castor-Oil, about one drop to each ounce of varnish.

UNKNOWN

148. All the labor and all the art thus far expended upon the negative may be sacrificed by heedlessness in varnishing. The varnishing-rooms should be absolutely free from dust. It is a good plan to gently sprinkle the floor before beginning. Some varnishes require heat both for their application and for their drying. After the plates are varnished they should be placed in a rack to thoroughly harden, and the printing paper should never be allowed to touch them until the varnish is free from all tackiness. Above all, let no dust settle on the varnished surface before it is hardened. Beware also of flies and insects.

148. The method I have adopted for some time past is simple, efficient, and reliable; and if not novel, is still, I believe, not very well known. It is to flood the negative, in the first place, with dilute amber varnish, and when dry, to coat it with ordinary hard spirit varnish; by this means the latter does not come into hard contact with the collodion film, and the alcoholic solvent is therefore without any action upon the same. Moreover, double protection is thus afforded to the negative, and from the fact that the intermediate varnish film is of a pliant and elastic nature, there appears to me less chance of any injury resulting to the negative from change of temperature, splitting of the film, etc. The amber varnish does not attack the negative film, by reason of the solvent employed (chloroform) being incapable of acting upon collodion.

I may also remark, that where it may be desirable to add to the durability of a negative—such, for instance, as when a large number of copies are wanted—it will be found an advantage to dissolve in the ordinary spirit varnish a small quantity of shellac, which will tend to give a harder and more durable coating to the negative. The brown or orange shellac, not the bleached quality, should be used; the former makes the varnish somewhat darker in color, but this is of no consequence.—Wm. England.

The property which wire-gauze possesses of intercepting the passage of flame, as exemplified in the safety-lamp, may be turned to account in the varnishing of plates.

A clear fire, every one will agree, is the best source of heat in the operation of varnishing, but there are times when it is not possible nor convenient to have fire-heat, and, in that case, the spirit-lamp or Bunsen burner is usually resorted to, and with the not infrequent result of the vapor of the varnish catching fire, to the detriment of the coating of varnish.

Now, by forming a strong wire frame (somewhat larger than the plates to be varnished), bent on one of its sides so as to form a handle, and covering this with fine wire-gauze (of either copper or iron), a plate-holder is made, upon which a plate coated with varnish may be warmed without the slightest danger of catching fire. The plate heated on this "quid" will also be more equally heated than when held naked over the flame.

If the wire-gauze is simply stretched over the frame, and stretched to it by fine wire, so as to form a flat bed for the plate, then it is evident that there must be something to prevent the plate from falling off when held in the nearly vertical position in which it is desirable the coating of varnish should "set." The iron frame, if formed of stout wire, will give a sufficient rim to keep the plate from falling off; or the same end may be gained by slightly dishing the wire-gauze, so as to make it like a flat photographic tray, or by even making it of the form of the dipping-bath, with, of course, in either case, a wire handle to hold it by.—J. W. Swan.

LESSON G.

THE MANIPULATIONS.

149. COLLODIONIZING.—With a stock of albumenized plates before us, we now proceed to make some negatives. In a collodion pourer at our right hand is our collodion. We seize the glass plate between the thumb and fingers of the left hand, at the left lower corner, raising it sufficiently to permit the eye to scan its whole surface, holding it perfectly level. Keep the breath from the plate and gently, with the mouth of the pourer close to the plate, pour out upon it a small oval puddle of collodion, sufficient to cover, say, two-thirds of the glass surface. Now rock gently so as to cover it wholly while flowing towards the right lower corner, whence return the surplus to your pourer. As soon as the surface or film is dried so as to be barely tacky to the finger, place the plate upon the dipper, still holding it in a horizontal position, that the film may be dried evenly before it enters the bath solution.

FIG. 36.

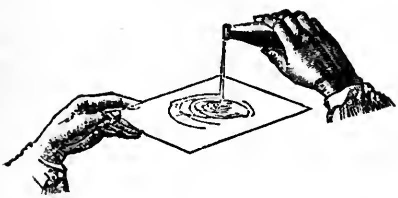
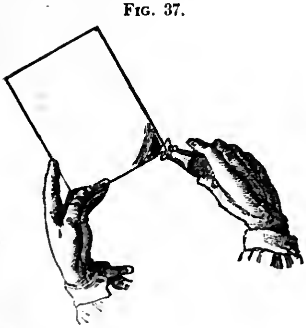


FIG. 37.



150. SENSITIZING.—The plate is now slowly and gradually lowered into the sensitizing solution, taking care not to stop it in the least until it is thoroughly covered, lest streaks occur upon it. It may be

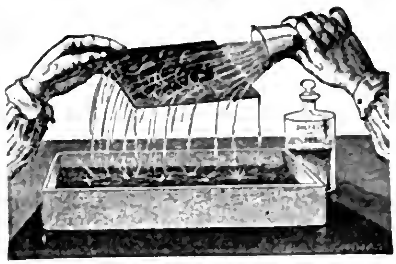
149. When a glass plate is coated with collodion and dipped into the nitrate bath, the salts of iodine and bromine will decompose and iodide and bromide of silver (which are very sensitive to light) will take their places on the film, while a combination of nitric acid with a base will remain in the bath.—DR. H. W. VOGEL.

150. Observe that the plate should always be put in the plate-holder in the same direction in which it is put into the bath, and be careful at all times to keep the plate-holder in the

"churned" gently up and down while in the bath solution. When upon examination the film appears smooth and free from greasy-looking lines, it is ready for exposure, and, being placed in the dark-slide, is carried to the camera, exposed, and brought back to the dark-room for development.

151. Development.—Open the shutter of the dark-slide, tip it towards you with the right hand, and seize the plate by the left upper corner with the left hand, holding it horizontally. Having prepared your developer before leaving the dark-room, you now quickly pour it completely over the film. There should be no hesitancy about this, lest one part develop more rapidly than the other. Rock the plate back and forth, the eye sharp upon it, to prevent the solution from gathering in uneven greasy patches, until it lies smoothly and does its work properly. If rightly exposed, the image will begin to appear in six seconds. If over-exposed, it will not be so slow about it.

Fig. 38.



same position. Before putting the plate in the holder, hold it up to the light a moment, to notice the density of the film, which should be perfectly smooth, creamy, not bluish, and semi-transparent. You will observe upon returning to the dark-room, after exposure, that the plate has gained considerable in density during the time it remained in the holder, showing conclusively that the decomposition was still going on during exposure.—Elbert Anderson.

151. The developer precipitates the silver from its solutions as a fine metallic powder, and this precipitate is formed also when we pour an iron solution on a collodion plate which is still *wet from an adhering silver solution.* When this solution is not present, sulphate of iron will not develop a picture. Acid has more the property to maintain the development clear than to retard the formation of a precipitate. Acetic acid also causes the developer to flow readily over the collodion film. Like alcohol, it also facilitates the adhesion of water to the collodion.—Dr. H. W. Vogel.

The developed picture, viewed by transmitted light, differs in its appearance, even when possessing equally favorable printing qualities. There are variations of color in the image, and of real or apparent intensity of deposit, which are caused by the changes and relations towards each other of the bath and collodion, as the acidity or neutrality of the one or the other predominates. Likewise, independently of duration of exposure, varieties of appearance are caused by change in the quality of the light; often in the same locality, on the same day, with the identical chemicals, negatives differing in translucence or opacity or color are produced, but which may, notwithstanding their varied character, all have nearly equal properties.—Lake Price.

152. FIXING.—The plate is now thoroughly washed and then placed in a tray containing the fixing solution. Should it be a properly exposed negative, all the yellow iodide unacted upon by the light will have been cleared away and the image indelibly fixed upon the portions of the film which remain—a perfect negative.

153. INTENSIFYING.—It should be the effort of the manipulator to so time his negatives in the camera as not to be compelled to resort to intensification. It is a bad habit to get into. The best results are obtained without it, and the skill of the good photographer is proven by his refraining from it.

154. VARNISHING.—By any convenient method heat the negative gently and evenly, until the hand may be borne upon it without pain. Now, from the varnish-bottle, pour upon the centre of the plate a pool of varnish, in the same manner exactly as the collodion is applied. Pour

152. From the developed picture we must remove the sensitive material, iodide and bromide of silver, on the one hand, in order to make the plate transparent; on the other hand, to protect it against further changes through the influence of light.—DR. H. W. VOGEL.

153. INTENSIFIER.—This term is used to denote those substances which, when applied to a negative, serve to increase the actinic opacity of the deposit already formed. One class of intensifiers acts by increasing the deposit of silver forming the image. To this class belongs a mixture of protosulphate of iron and acid.—LAKE PRICE.

When the negative has been assisted, in an inefficient exposure, by the addition of drops of nitrate bath to the developer, the peculiar "bloom" of high actinic quality will not appear when examined by diffused light; in its place darker tones and more opaque deposit of a *blue* or *black* character are seen. They are less satisfactory, being deficient in the truth and delicacy of gradation possessed by the former, and are apt to be very deceptive when printed; dark and vigorous-looking negatives occasionally allowing the light to permeate through their texture, whereas the most translucent of these, impressed under favorable actinic conditions, have a great power of resisting it, although their weak-looking, light-brown deposit would appear ill adapted to do so.—LAKE PRICE.

154. The *best* printing qualities for a negative to possess are the following: The high-lights in the picture, that is to say, the most intense portions of the deposit, should allow the flame of a candle to be *just seen* through when held behind them; if of too great an opacity to admit of its being perceived at all, the resulting positives will probably be chalky and bare in the lights, and deficient in half-tones. *Very small* portions, representing actual *white*, should be of absolute opacity. There should be a *general* deposit of silver, with *considerable variations* of intensity over the whole surface, with the exception of the most vigorous darks, and in them it should approach *very nearly* to the bare glass, but only in small portions; if in large masses, it would denote under-exposure. Held up to the light, their color should be of a warm inky brown; when the plate is held horizontally over a dark ground, and viewed by diffused light, the appearance which especially distinguishes the deposit on the film in all negatives of the highest capabilities is a warm *drab* color, technically termed

off the residue into a separate vessel, to settle before using again. Keep the plate in a horizontal position until the varnish be nearly set, and then stand it upon nails driven into the wall or upon a rack to dry. See 148.

155. Retouching the Negative.—After the negative is varnished, it must be retouched. This is done by means of lead-pencils of various grades, which are so worked by hand or machinery as to improve the printing qualities and the appearance of the model, too. The greatest care should be exercised by the retoucher not to alter the likeness or overdo the thing. The roughness of the skin, freckles, and blemishes need to be obliterated, but the half-tone in the negative must also be carefully and judiciously preserved, lest all the charm of the picture be gone.

156. For this work a retouching-frame or desk is needed; a few of Faber's black lead-pencils; black-lead powder; India ink; a few sable hair-brushes, and some stumps. There are various preparations also for giving a "tooth" to the varnished surface, which must be applied in order to make it take or "bite" the pencil. A rough proof from the negative should be before you to guide you. Once knowing what is required, one can, by careful practice, become expert in a short time in this delicate and important operation. This done, the negative is ready for the printer.

"bloom" in negatives developed by pyrogallic solution; in those by iron it is rather more silvery gray and metallic. Such negatives are sure to print well; all the objects represented by them will be rotund in appearance, because their forms are thoroughly delineated by delicate half-tints, and the extremes of light and dark, with all the intermediate tones, will be well expressed. Their effects will be bright and spirited, equally removed from the vapid monotony of *over-exposed* negatives, which, deficient alike in both whites and blacks, lose the power of the scale and range of *chiaro-oscuro* which the two extremes should give them, and, from the crude and misshapen forms of the *under-exposed*, which fail because wanting the softening beauty and *drawing* given by middle tints.—Lake Price.

155. Retouching the negative has grown somewhat unpopular from excess or lack of skill, but seems to me quite legitimate work. But that is not the kind of aid of which I am thinking. I have lately been examining some of the best plain photographic portraits I can find, and they seem to me to be, as the artist says, "out of keeping." At first sight they appear perfect, and all right, but they don't wear well. After a little study they grow weak, and, unlike good art, they do not reveal some fresh beauty every day. The likeness is there, but is thin and spectral.—Charles Akers.

156. Retouching, like any other good thing, is liable to abuse, and it is due to this abuse that the opposition to it has arisen. Unfortunately, in a great majority of cases, the retouching of a negative is intrusted to unskilled hands,—persons who have no idea of the drawing and modelling of a face, the artistic effect of the touch, or even the printing requirements of a negative. This is all wrong. Retouching should only be done by an artist—I mean a person with artistic taste and ability (for all of the so-called artists do not possess these qualities).—N. H. Busey.

LESSON H.

MANIPULATORY MISERIES.

157. From what has been written of photographic manipulation thus far, it would seem to be all clear sailing. But it is not. Troubles innumerable occur continually—daily—which baffle all our experience, and which would send us far out at sea oftentimes, were there not sundry—not always certain—indications to prevent too much drifting, to hail us and to guide us on the journey. It should be the rule with every careful manipulator to *act* as soon as the least danger-signal makes its appearance. Make no delay in tracing whatever trouble or defect comes to its very source, and annihilate it, if you can, immediately. Stop the leak, disperse the fog, turn from the storm impending as soon as the "indications" warn you. Thus much trouble and loss will be avoided. Carelessness, uncleanliness, lack of attention to what you know, and lack of desire to do well, are the great causes of annoyance.

158. The troublous effects, or defects, will now be treated fully. One of the most common, and therefore the oftenest met, is known as veil or

157. I have travelled a great deal, and have found the trouble solely this: that the photographers who do not have success in working have no rule or system to work by; and if so, they neglect it and are careless. Now, my rule is as follows: Use your chemicals as you do yourself. In cold weather strengthen them, and keep them in a temperate state. Test everything; never *guess*, as it is commonly called. Be sure you are right, then go ahead, and success is certain.—Carl Von Moelke.

Then, when once you are in a decently clean shape, for the love of humanity, the respect you *ought* to have for the profession you have chosen (from whatever motives), do not let a lot of old trash or dirt accumulate. If we ever expect to be anything but *poor photographers* (in every sense of the word), if we ever expect to bring our profession up "to the mark of its high calling," if we ever expect the "dear public" to respect us, and ever speak of us in any other way than as "only a photographer," we must come to that point where we can at least respect ourselves.—H. R. Farr.

158. Fogging.—When a precipitate is thrown down over the entire plate by the action of the developer, so as to obscure, in the deepest shadows, the transparency of the glass when looked through, that precipitate is called "fog," and the picture is said to be "fogged." The principal causes of fog are: alkalinity of the nitrate of silver bath, or neutrality of the

fog. It is as insidious as foul air, and both causes and hides many other imperfections. It is caused in many ways. Among them the following surely produce fogging: 1, want of union between the collodion and the nitrate bath; 2, want of sufficient acid in the developer; 3, want of sufficient acid in the nitrate bath (or an excess of acid will sometimes produce the same effect); 4, diffused white light in the dark-room, camera, etc., caused by not shutting the door close; having cracks and chinks in the partitions; not having the yellow glass sufficiently dense to obstruct all the white light; taking the plate out of the bath too near the gas or lamp, and by developing too near the same; by want of care in redeveloping, and light reflected from surrounding objects, thereby obstructing the direct rays from the sitter, which alone should pass through the lens. It may also be caused by excessive over-exposure, and by under-exposure, with too long a development; also by keeping the plate too long after taking it out of the bath before development. It is also very frequently caused by the fumes of ammonia, turpentine, and other volatile chemicals standing about upon the shelves of the dark-room. It is easy to *produce* foggy negatives without the chemicals being in fault.

159. How are we to tell, then, the cause of this monstrous trouble? We naturally look first at the chemicals. Is it in them or not? How

same when a bromo-iodized collodion is used; over-acidity of the bath; diffused light, either in the camera or dark-room; dirty plates; and sometimes from the lens itself. An alkaline bath and a very acid one seem to have very similar properties as respects "fogging." It is only when the acid and alkaline elements are properly balanced, so as to suit the nature of the collodion, that a good photographic negative can be obtained. No collodion can be worked in an alkaline bath, but a pure simply iodized collodion when it turns to a pale sherry color, can be used with the best effect in an absolutely neutral nitrate solution. Collodion, paper, or any sensitive medium which contains besides the iodide an organic compound, must always be sensitized in an acid bath to prevent "fogging." Should the bath "fog" upon trying a plate, and the cause be *in* the *bath*, add five or ten drops of nitric acid, stir well, and try another plate.—ELBERT ANDERSON.

159. "Fogging" is a general obliteration of the forms of the subject in an *opaque* film, which prevents them from being clearly distinguished, in whatever direction they may be viewed. This is caused in a variety of ways. It may result from the unskilful use of the developer itself; if it is of too great strength in warm weather, when it should have been reduced in power by the addition of distilled water and acid, "fogging" will ensue, or, at a more moderate temperature, prolonging the time of development beyond a certain limit will cause the same blemish. If weakening the solution in the one case, and shortening the developer in the other, does not remedy the evil, the nitrate bath must be tested for alkalinity with reddened litmus or turmeric paper.

When there is only a very slight tendency to "fog," it is better not to touch or alter the

shall we determine it? We will make a search. Darken the room and light the gas. Take a perfectly clean plate, coat it with collodion, dip it as usual in the bath, and cover it over. While it is coating, take the plate-holder and lay it flat down, open it and put in a negative, varnished side up. Then lay a narrow strip of cardboard on each end of the negative, so that when the sensitized plate is put in it will be as near in contact with the other as possible, without touching. The plate being now coated, turn down the light to the lowest point, remove the plate from the bath, and, after draining it carefully, lay it collodion side down upon the strips of cardboard, and fasten the frame. Now turn up the light, and hold the plate-holder three or four inches from the gas, draw the slide, and expose it four or five seconds; if the light should be a lamp, expose longer; shut the slide, and then turn down the light as before, and develop. The result will be a positive by transmitted light. If it is clear and brilliant, free from fog, there is no fault with the chemicals.

160. If on the other hand it proves foggy, the trouble is probably in the collodion, because, if the bath is made according to directions, and

bath; by using a more highly colored sample of collodion perfect clearness of definition will be restored to the film, whilst at the same time every plate of such quality of collodion that is dipped will tend gradually to displace, more and more, the small tendency to alkalinity existing in the bath.—Lake Price.

160. The developer will naturally reduce the silver on any part of the plate that has been "struck" by light; this will be in irregular masses, and only at such places of the plate as were "light struck." The collodion is rarely, if ever, the cause of fogging, for a collodion made as I have directed cannot be or become alkaline; for if it should be colorless when *first* made, I have directed the use of a few drops of tincture of iodine, or the addition of one-fourth of its volume of an old and red collodion made by the same formula.

If the chemicals have been prepared according to the directions given, and the bath is slightly acid, as also will be the collodion, fogging cannot occur until the bath becomes disordered, or a change is made in the collodion or in the developer. Coat a plate carefully, and immerse it in the bath slowly; when properly coated, develop it (exactly as if it had been exposed, and keep on the developer for about the same length of time); wash off the developer under the tap and "fix." If a universal layer of mistiness cover the entire plate, and lie only *on* the film and not *in* it, the bath is in fault; if, however, there should be *any portion* of the plate perfectly clear, the chemicals are not to blame. Should the bath prove alkaline, which is not to be expected, the cause of fogging in this instance is the presence of organic matter, which a slight addition of nitric acid will dissolve. Should the bath prove acid, no more acid should be added at this, nor at any other time, to the bath. If a newly prepared bath "fog" but very slightly, let it stand quiet all night, and it will be found to work clean and bright on the morrow.—Elbert Anderson.

With certain kinds of developers there will form, after a lapse of twenty, fifty, or sometimes of sixty or eighty seconds, on the surface of the liquid floating figures of a description

without doubt is slightly acid, the chances are not one in a hundred that the trouble is there. So, in such a case, examine the collodion; if it is a very pale color, it is neutral and perhaps alkaline. This is the very worst state it could be in if clear negatives are desired. An alkaline collodion coming in contact with an acid bath causes a slight effervescence, which is fatal to a perfect union between the collodion and bath. To secure perfect harmony between them, if one is slightly acid the other should also be. Such a condition is far preferable to a neutral one.

161. The nitrate bath probably comes in for more censure than any of the solutions used in photography. It is often innocent, and more often

exactly similar to the appearances produced by this sort of fogging upon the plate. They consisted of groupings of particles of metallic silver, changing their shape and figure at every instant, but always having a resemblance to the figuring of marbled paper, which is made, as every one knows, precisely in a similar way, by the distribution of colored films on the surface of water, from which they are transferred to the surface of the paper. Just in the same way these curious silver figures are presently transferred to the surface of the plate, to the inexpressible annoyance and discomfiture of the operator. Why films thus loosely deposited should adhere with such tenacity to the collodion, it is difficult to say; perhaps they are presently soldered fast by the advancing deposits of silver.

Almost all developers when examined in this way, by daylight in a capsule, showed a tendency to this form of fogging if their action was continued long enough. Developers which quickly become muddy show these figures simultaneously with the muddiness, but they were smaller and less marked. Strong and well-balanced developers did not show them nearly so soon; but they were larger and most conspicuous, and *would present themselves when there was not the slightest turgidity in the liquid.* It seems like a sort of reversed development—a development upwards instead of downwards.

These spots first form and show themselves on the surface of the liquid, on which they float freely. When the plate is tilted in order to pour off the developer, they do not follow the liquid; but the latter slips out from between, and deposits them delicately on the film. It would seem, then, that if the plate were carefully watched, keeping the eye on the surface of the film, as well as on the developed image, and the moment a tendency to the formation of these figures was detected, the operator, instead of pouring off the developer, was to quickly set the plate (always holding it quite level) under a good stream of water issuing from a rose, these figures *could not get down* to the film. It is not their nature to sink through; they seem to adhere to the surface, and only reach the film by being left behind by the retiring wave of water, and then the whole stratum of developer is suddenly washed away by a stream of water which floods the whole surface. The floating figures must be carried away without an opportunity of fastening themselves to the film.—M. Carey Lea.

161. I could write a chapter expressive of my annoyance at that disgrace to professional photography—a dirty operator. In no respect does he more exhibit his obnoxious character than in the way he misuses the nitrate of silver solution. He splashes the walls with it, stains the floor, corrodes the metal-work, rots the dark-slide and camera, spoils curtains, chairs, and carpets, saturates his clothes, dyes his hair, blackens his hands, and defaces his

abused and misused. While it is the photographer's best friend, it is hated by him as though a "poor relation," and for years the inventive genii of the craft have been racking their brains for some means of abolishing it. The bromo-gelatin process promises much, but we cannot give up the nitrate bath for a time yet. Therefore, a few more thoughts concerning it and its treatment properly belong here. If difficulties occur with it, nine cases out of ten they result from the neglect of yourself. It may be you abuse it—it may be you have overworked it. To discover the trouble, the first step is to test its strength by any of the well-known methods. Pile's silver-test is the best.

162. Oftentimes a simple means of rectifying the bath is sufficient to put it in perfect working order. If it is too acid, cyanide of potassium

countenance. The idea never seems to occur to him that the solution was not intended for any one of these purposes, and that it is not only wasted, but doubly so, by doing nothing but injury by its misuse.—Alfred Hughes.

This method, which has been proposed by Professor Towler, consists, in brief, in precipitating the metal by means of zinc, drying and fusing it to a metallic globule, and then weighing it. Take an ounce of the bath solution. Next, in a porcelain vessel place a slip of zinc weighing about half an ounce, together with an ounce of water and a drachm of sulphuric acid. Effervescence will at once take place, and during this the silver solution is stirred in. The silver rapidly deposits as a gray powder. After a few minutes, brush off the silver from the zinc with a hair pencil, add water, and wash several times, taking care that no silver is allowed to escape. Now drain off the water and dry the mass; mix it with about twice its weight of borax, and fuse it by a blow-pipe flame. The quantity of silver per ounce of solution will thus be seen. But Professor Towler's method, as described, is not quite so good as the following method: Take a measured ounce of the bath solution and immerse in it a strip of magnesium ribbon, stirring well. Silver is at once thrown down, and after ten minutes a few drops of acetic acid are added to dissolve all traces of magnesium. The silver deposited is free from all impurities. It is washed and fused as before. Twelve grains of magnesium will precipitate one hundred and eight grains of metallic silver. This, as I have said, is a more convenient, simple, and accurate way of testing the strength of a silver bath than that proposed by Dr. Towler, and it can be very strongly recommended.—J. Traill Taylor.

162. The value of permanganate of potash for rectifying disordered negative baths and printing baths has received much confirmation during the past year. A correspondent of one of the journals describes his experience thus:

"Permanganate of Potash,	15 grains.
Pure Water,	4 ounces.

"I poured into my bath about a teaspoonful of the above. In one minute it had the appearance of very dirty ink. I filtered it, after which it looked very yellow; I dropped in a little more of the permanganate, and set it in the sun for ten minutes. It then assumed a clear, bright, pink appearance; I filtered again, and again set the solution in the sun. In fifteen minutes the excess of permanganate had precipitated in the shape of a black, gummy-looking

may be used, or nitrate of barytes is often found helpful. The permanganate of potash is also resorted to with good results. The choice of these should depend upon circumstances and conditions, though their action is much alike.

163. In handling a bath solution, much waste may occur if the operator is not careful in pouring the solution to and from the bath-holder. A siphon may be used for the larger solutions with greater assurance against accident and loss. With care, no loss need necessarily occur by either method.

164. One of the gentlest means of curing a disordered bath is by giv-

matter. I coated a plate, and placed my subject, exposed, developed, and the nicest chemical effect I had ever seen was the result. I have worked that bath for six weeks with all sorts of collodions, and only once has it given a foggy picture; then a few drops of the permanganate set it right."

Another correspondent, speaking of its use in printing-baths, says, "I proceed as follows:

"Permanganate of Potash, ...	1 drachm.
Water, ...	2 ounces.

Dissolve the permanganate in water, and add with caution to the old bath until you obtain a milky-purplish color; let it remain over night, after giving it a thorough shaking. You will find quite a large amount of foul matter has fallen during the night. The solution can now be filtered nearly clear. Now proceed as with an old negative bath, which is, to add the solution of permanganate of potash as above to this filtered solution until you obtain a stronk pink color; let it remain for a few hours, after stirring well before filtering; if quite alkaline, add nitric acid until it turns litmus-paper pretty deeply red, then aqua ammonia until it is as alkaline as you usually use your bath."—G. WHARTON SIMPSON.

163. The following is a good way to empty a bath-holder without wasting the contents. Simply use a white cotton string or twine, tied about an inch or so from the edge, and if the *glass and twine are dry* not a drop will be wasted.—J. L. GIHON.

Take any length of rubber hose, of size required for business in hand, press one end tightly on a wooden roller (almost anything will do), rolling up till just enough is left to reach in the solution; be sure you keep it there, and commence unwinding, keeping the end not in the solution held tight, pass it in the bottle or hold over the vessel used; in this way you will find the solution to pass over and out readily. I think this is more feasible than the one with glass tube intervening, but that is very good.—J. C. GOETCHIUS.

Another thing which *may* be new, and therefore valuable to *some* of you, is, how to draw off your bath. Get a piece of rubber tubing, say four feet long, put one end in the bath and drop until all is covered except just your finger-hold; pinch lightly, pull out, and insert in the mouth of a bottle. When that is full, pinch together until you direct into another bottle. In this way, simply by having the tubing reach the bottom of the bath, and discharging outside at an inch or two lower, you can draw off your whole bath without much trouble and with no waste.—N. D. RANDALL.

164. A QUICK WAY TO SUN A BATH.—Pour it out into a flat porcelain dish and leave it in the sun, sheltered from the dust. The bath should first be neutralized, say with

ing *it* a sun-bath. Many disbelieve in such treatment, but it is largely practised and is very good. It is slower than some other means used, but it is none the less sure, and is certainly not liable to accident.

165. Another method is to "boil down" the bath. The water and other fluids it contains are thus evaporated, when the silver crystals are again dissolved in water as when the bath solution was originally made. A still further method is to fuse the silver, the advantages of such a method being considered greater than those gained by simple evaporation to dryness.

carbonate of soda. In a few hours a black scum will be found on the surface of the bath. This can readily be removed by a strip of blotting-paper, and the solution is again free to the action of the sunlight. This should be repeated every few hours until the bath remains clear, or nearly so, when it is ready to be filtered and diluted by the addition of water, for, as will be readily understood, during the process of sunning in a flat, open dish, there has been considerable evaporation of both water, alcohol, and ether. After being diluted, filtered, and acidified, it will be found to work as well as ever it did, free from streaks, stains, and pinholes. The advantage of the dish over the bottle, so generally used in sunning, is, that the black scum which collects on the inner surface of the bottle obstructs the rays of the sun, and prevents the free access of light to the solution, and thus renders the process of sunning much more lengthy and tedious than when the dish is used.—J. L. Gihon.

I should be very sorry to show disrespect to any one whose opinion differs from mine; nor do I intend to. I only wish to express my own very forcibly in regard to "sunning" the bath. That is all bosh! It can possibly do no harm and does some good; but half an hour's *boiling* is worth a year's "sunning."—Elbert Anderson.

165. There is a compound of silver which a photographer might unwittingly produce—the fulminate of silver. If a solution of nitrate of silver containing nitric acid be warmed, and alcohol added, a white precipitate forms, which is the compound in question. A photographer evaporating to dryness an acid bath which had long been in use, and contained alcohol, might find himself and his dishes elsewhere towards the termination of the boiling down of the solution.—Old Argentum.

To fuse a bath pour the bath into one-fourth its volume of water, and filter out the precipitated iodide; place the solution into an evaporating-dish on the stove, and evaporate to dryness, *without* neutralizing with ammonia or any other agent. As the solution becomes dry, a series of phenomena takes place; minute bubbles commence forming in the centre of the dish and gradually spread out to the sides. They increase in size and become violent in action, finally breaking open and emitting masses of vapor. When this has all ceased, scrape the mass into the centre of the dish, where it will commence to liquefy again; or, in other words, to melt. It will soon have the appearance of a heavy oil or syrup, and may be considered *fused*. When cool, it can be dissolved in pure water, diluted to any extent, and used as required.—Elbert Anderson.

Boil down in an evaporating-dish the refractory bath, and, when nearly dry, it will froth up very much; therefore take care to have the vessel large enough. After a time the frothing will cease, and the contents of the dish will settle down into a crystalline mass. Continue the heat, taking care not to have too much, or the silver will again froth up, and after

166. And yet the means of rectifying the bath—of saving it from being utterly cast out and aside—are not yet exhausted. While ingenuity has been greatly exercised to find a substitute for it, as much thought has been given to discover means of saving it and making it do its duty. There are those whose time is so valuable that they can better afford to make up a new bath than spend time in doctoring an old one; all cannot. The notes which follow will be found very helpful to all who are in the midst of bath troubles.

a time become perfectly liquid. It is now fused, but the operation should be continued until all bubbles have disappeared. The dish should now be set aside to cool. When cold, a gray cake, not unlike toffee, will be formed at the bottom of the dish. The fused silver should be dissolved in distilled water, but it will be quite a work of time, for the cake will be found as hard as a stone, and very insoluble. When in solution, sufficient water should be added to make forty grains per ounce. On trying a plate after the addition of a drop of dilute nitric acid, the result will be quite equal, if not superior, to that obtained in a bath of new silver.—VALENTINE BLANCHARD.

Put the solution to be clarified into a porcelain dish over a slow fire or a Bunsen burner, and, when boiling, drop by intervals into it pieces of caustic potash, stirring all the time with a glass rod. Continue this operation until the solution ceases to precipitate in the form of a brown-black powder, which is an oxide of silver. In order to be certain that the reaction is terminated, take a few drops of the solution and put it into a glass with a little distilled water; in adding a small quantity of hydrochloric acid, if the solution remains clear, the operation has been well conducted; if it turns of a milky appearance, more potash is required. The oxide of silver obtained must be well washed; it can then be dissolved in nitric acid, in order to form pure nitrate of silver.—PROF. E. STEBBING.

166. I will now describe my process of treating an old bath, by which it may be made not as "good as new," but better; that is, *as good as old*. *First*. Filter the old bath into a bottle. Add silver, if necessary, until it is forty grains strong. *Second*. Add an excess of cyanide of potassium (about one grain to each ounce of silver nitrate is sufficient); shake thoroughly until no more cyanide of silver will dissolve; let settle; decant the clear liquid, and filter the residue. *Third*. Add three fluid drachms of No. 8 acetic acid to each quart of solution. *Fourth*. Neutralize with bicarbonate of soda, and set in the sun until it settles clear. Filter. *Fifth*. Add pure nitric acid, beginning with one-half fluid drachm to the gallon, until all tendency to fog is removed. When more bath is needed, proceed in the same manner with the new, after having dissolved the silver and iodized it as usual; add the new to the old, and your experience will be different from mine if you do not find it better than a new bath.

The composition of this bath is peculiar. The addition of the cyanide alone causes mat silver stains in abundance; then, after adding the acetic acid, the most intense fogging will follow. The next step is also remarkable; for, in neutralizing the acetic acid, a considerable quantity of acetate of soda is introduced, the *usual* result of which would be precipitation of acetate of silver. Instead of this, a double salt is probably formed, more soluble than acetate of silver. Finally, the addition of nitric acid liberates a portion of acetic acid, and forms nitrate of soda.

167. As has been hinted already, the *abuse* of the bath solution is oftenest the cause of its refusal to do its duty. It should not be overworked. It should be kept at a proper degree of warmth in winter and of coolness in summer. All the other chemical solutions should be made to work in harmony with it. These things being properly attended to, there should be no unusual trouble with it.

The developer which I use with this bath, and recommend, is composed as follows:

Protosulphate of Iron,	4 ounces.
Acetic Acid, No. 8,	10 fl. ounces.
Alcohol,	4 "
Water,	2 quarts.

W. H. SHERMAN.

When the bath yields dull negatives without vigor, or fogged pictures, it is usual to render the solution alkaline by the addition of carbonate of soda until a permanent precipitate is formed, and then to expose it for several days in the sun, to filter it, and finally to add a few drops of nitric acid to bring about a slightly acid reaction. Thus doctored, the bath usually becomes good; but in winter, when there is no sun, the bath sometimes freezes externally, and several days are necessary before it is again in good order.

The method I am about to indicate is not only very rapid and very effective in removing the iodide of silver, but likewise puts the bath into such order that it is capable of producing negatives as clear and brilliant and free from fog as a new bath in good condition.

Two solutions are prepared as follows:

A.—Citric Acid,	10 grammes.
Distilled Water,	100 "
B.—Caustic Soda,	10 grammes.
Distilled Water,	100 "

For each litre of silver solution to be corrected, two cubic centimetres of solution A are added, and the bath well agitated to disperse the citric acid through the liquid. Five cubic centimetres of solution B are next put in, the liquid being again shaken, and there becomes formed a brown precipitate of oxide of silver, which partially, or even entirely, disappears if the bath happened to be in an acid condition prior to the addition of the citric acid. A further quantity of five cubic centimetres of solution B is added, and if, after energetic agitation, no more of the brown precipitate disappears, no further quantity of the solution should be added.

The bath is now poured into a glass bulb without being filtered, and heated under a spirit-lamp until it boils. The solution will by this means become perfectly black by the precipitation of the organic matter, which, as we know, was the cause of the plates becoming fogged. The boiling should not, however, last for more than a minute, after which the solution is allowed to cool.—WM. ENGLAND.

167. Never work a bath after it has become necessary to add alcohol to the developer to avoid "crawling," but dump it into an evaporating-dish and boil the alcohol out of it. Let it get cold, and reduce to forty grains strength; add enough new solution to renew the original quantity, and the bath will not be over-iodized, and will work splendidly again without any sunning, unless it was also overcharged with organic matter. In that case the

168. A method of testing the strength of a bath has already been given. This for the photographer who really has some conscience and a little feeling for his stock-dealer. For those who have not, the following note is given to show about how much can be honestly expected from a given nitrate

boiling should have been continued until only a few ounces of solution remained, and sufficient oxide of silver (AgO) added to take up all the free acid, and proceed as before to reduce to forty grains, and increase in quantity; then filter and sun until perfectly clear; filter again, and add fresh nitric acid as to a new bath.—F. M. SPENCER.

The cold affects the chemicals by rendering them torpid, whereby they lose one-half of their power and energy. The collodion sets slowly, and the resulting plate, instead of coming out of the bath rich and creamy, will be thin and transparent, of a bluish color; the developer works slowly, depositing nearly all the silver upon the whites, thereby giving too great a density to the negative, and with difficulty bringing out the details. The result is an imperfect negative, with very little chance of doing better next time. Heat increases chemical action and cold decreases it. Cold renders long exposures necessary, and produces hard negatives without detail. On the other hand, too high a temperature will give flat negatives without contrast, with a tendency to spontaneous reduction, otherwise called fog. We must, then, to be successful, steer clear of both extremes. If possible, the temperature of the rooms should never be below 55° nor above 70° Fahrenheit. This temperature should be maintained as near as possible, night and day, by the aid of artificial heat. More particularly is it necessary at night, because, when the heat is allowed to go down after the work of the day is done, the chemicals are all chilled by morning, and, although it may take but a few minutes for the room to get comfortable, it will take many hours for the heat to penetrate through the bath and solution, and just as they begin to get in tolerable working order it is time to close business, and you go again in the morning to find the same trouble.

Another strong reason for an even temperature is to be found in the fact, that a sudden rise of temperature in a cold room condenses moisture upon your negative glass and the lenses of your instrument, upon the same principle that it does upon a pitcher of ice-water when carried into a warm room. This moisture will cause the film to slip off your plates during the manipulations, unless they are warmed sufficiently to drive it off before coating.—GEORGE H. FENNEMORE.

Years ago I used to carry ice for miles, and have my bath stand in a box of ice, and imagined it was a great thing; but in many places it could not be got, so I had to look for other means of working in extremely hot days. First of all, I learned to keep my best bath for hot days—I always carry *two*—and, by judicious use of acid in my developer (putting it in in addition to what is already in the developer, after putting the developer in my developing-cup, altering the charge of acid as I see I need from one exposure to another), I get along. Next be careful and not over-expose, for this is one great source of failure. In hot weather a plate but slightly over-exposed has lost its snap, and cannot be relied on for a brilliant negative.—B. W. KILBURN.

168. A 12 x 10 glass bath, holding about 80 ounces of new solution 35 grains to the ounce, and made with distilled water and three drops of nitric acid, did 213 plates 7¼ x 7¼ inches, being about 60 square feet. It gave up suddenly, needle-like crystals being formed all over the plate, on the inside of the bath, and on the dipper. Before this point was reached, the

of silver solution, and how much more may *not* be expected from it. And with it well digested you are in condition to investigate further troubles.

169. Collodion is liable to frequent and rapid changes, and needs to be continually modified to suit the condition of the bath. This is easily done, however. The best remedy for a pale, neutral collodion is to take from the stock-bottle as much as will last for the day, and add to it a little old red collodion until it assumes a rich orange color; or a drop or two of tincture of iodine will do as well. Let it stand a few minutes, when a great improvement will be found. On the other hand, if the positive picture is clear and brilliant, and the negatives are foggy that are made by day, the trouble undoubtedly comes from light penetrating in some place where it ought to be excluded; the only remedy for which is to find the enemy, put him out, and keep him out.

plates developed very weak, and there was difficulty in getting the developer to stay on the plate. The developer was

Saturated Solution of Iron, ...	4 ounces.
Methylated Spirit, ...	4 "
Glacial Acetic Acid, ...	4 "
Bottle filled up with Water, ...	80 "

Now that nitrate of baryta is used in the bath (ten or twelve drops of saturated solution in a 12 x 10 bath), probably more plates could be done; but it is usual to discontinue the use of the bath as soon as it is found difficult to keep the developer on the plate. Probably about 170 or 180 plates may be done before this happens. A bath holding 80 ounces of solution 35 grains to the ounce, when it was discarded as worn out, was found by the argentometer to register 16 grains; it had also diminished in quantity nearly one-third. The number of plates sensitized in it was about 180 $7\frac{1}{2}$ x $7\frac{1}{2}$.

Quantity of Silver at first, ...	2,800 grains.
Quantity in the Bath left, ...	880 "
Quantity used, ...	1,920 "

Practically about ten grains a plate; about two cents' worth of silver, or six cents a square foot. With a bath made of new silver and water, the plates at first come beautifully bright; but rapidly a surface fog accumulates, which gets worse and worse with every plate that is put in the bath. When this occurs, the bath has to be taken out, and a few drops of a saturated solution of baryta added, and stood in the sun for a day or two, when a deposit takes place, and, after filtering, the surface fog never appears again. In the former case, when the surface fog is rubbed off, the film under is bright, like bare glass, whilst in the latter, after the addition of the baryta, the film is granular, looking something like very fine ground-glass. The glass plates are all albumenized before coating with collodion; probably this has something to do with it. In every case the development is pushed to the utmost. The fog here spoken of would not be noticeable in a negative, nor the granular film; but in the case of transparencies for the lantern, where absolutely bare glass is needed, it is very obvious.

170. And not only does the collodion sometimes *cause* very annoying troubles, but it is itself subject to annoyances which either impair its value as a helper or render its work useless altogether. If it is suffered to evaporate, it becomes thick and unmanageable. Should it be kept too long before use, it becomes red, thick, and works with too great intensity. When it is salted in a certain way, it may not be used with good results until it is several days old. If diluted, or impure chemicals are used in its mixture, it will rebel; and if the bath is not in harmonious condition there is no end to the troubles which will occur.

Adding more nitric acid to the bath did not diminish the surface fog nor the granularity of the film. Adding iodine to the collodion did tend to clear the film, particularly the granularity, but did not remove it unless an enormous quantity was added, making the collodion quite dark, in which case the exposure was very much lengthened, and the resulting image very weak. The best result was obtained with the collodion a dark sherry color.—R. Gillo.

170. I have suffered great annoyance from collodion admirable in every way except being too thick, thus making it impossible to flow a plate evenly. The trouble was intolerable when I had occasion to make a picture with a delicate sky. I tried to remedy the evil by reducing the collodion with alcohol, but it was always at the expense of sensitiveness, making the exposure necessarily longer and the resulting negative very inferior. I then tried equal parts of alcohol and ether. I found that better than the other, but by no means satisfactory.

This state of affairs had cost me a good many pounds of collodion, perfect in every respect except in being too thick, when the query arose in my mind, "What does a perfectly balanced collodion lose first, when it begins to deteriorate?" "Why, *ether*, of course," answered reason; "and it wants ether to replace that which is lost." I tried this with perfect success, and now find a bottle of good ether one of the every-day necessities in my practice.

I mention this because I have been much tried and could find no remedy. I have seen alcohol alone recommended, and equal parts of ether and alcohol, too; but my experience is that a perfectly-balanced collodion, when it is new, wants ether when it gets thick. Add from day to day as you see it. It is a perfect cure.—B. W. Kilburn.

Structural Crapy Lines.—Marks from glutinosity will sometimes occur when using cadmium as an iodizing solution. A sample of plain collodion which gives these markings will probably be free from them after keeping for a few months without any further treatment. Structural lines on the film also frequently depend upon the plate not being properly rocked whilst pouring off the collodion. Some operators dilute glutinous collodion with ether, but in doing so there is always danger of precipitating the iodide of potassium, and, if the pyroxylin be of that kind which sets very rapidly, the use of too large a proportion of ether will produce markings of a different kind.—T. Frederick Hardwich.

A source of great waste among photographers is that of old collodion. It can be renovated and used again by the following process: Pour off the collodion from the sediment, and add subchloride of mercury (Hg_2Cl)—calomel—until a greenish color is assumed when shaken. Then allow it to settle, and add more calomel until, by shaking again, the collodion appears of a canary-yellow color. Now, if it is very old and thin, either add more cotton to it or mix it with your new collodion. When thus treated, it will never turn red again.

171. Semi-zigzag lines, running from the edge of the plate that first enters the bath solution upwards, attract us next. These are also caused by a want of harmony between the bath and the collodion, but for a reason different from that which creates fog. If the collodion be too highly iodized to suit the strength of the bath, then these lines or marks will occur. The remedy is to test the bath, and add silver until it reaches the strength of a newly-made bath. Should the lines, after trial of a plate, still appear, then add plain collodion to the iodized, a little at a time, until the lines are no longer seen on trial of further plates.

If it should not work as sensitive as new collodion, add one drop of aqua ammonia to each ounce of collodion *as you use it.*—J. R. CLEMONS.

You will find in practice that a *soft, spongy* collodion will always be highly sensitive, for the reason that its *mechanical* constitution is such that the molecules of silver move more freely within and throughout it,—that is to say, with less friction,—and rearrange themselves, by the action of the light, more readily than they do when enveloped in a tough or hard collodion. No doubt, a part of the success of the "acid bath" is due to these facts, for the great quantity of acid tends to make the collodion film peculiarly tender, velvety, and soft, and thus affords the most delicate gradations of light and shade. I will give the formulæ for collodion and bath, such as I am now working, and will only say that, like all other formulæ, they must be used with *judgment.* Chemicals, particularly soluble cottons, are not always uniform, and the formulæ must be modified to suit varying conditions. For general work, I use collodion made as follows:

Alcohol,	9 ounces.
Ether,	6 "
Soluble Cotton,	108 grains.
Iodide of Ammonium,	18 "
Iodide of Cadmium,	18 "
Chloride of Calcium,	9 "

The nitrate of silver bath I make of nitrate of silver, twenty grains to the ounce of water, and for every two quarts of the solution add half an ounce of C. P. nitric acid. The amount of acid used must depend upon circumstances; you will probably require more acid. I often use as much as *two ounces,* or more, with success, in two quarts of solution. To develop, I use from fifteen to twenty grains of protosulphate of iron to the ounce of water, with enough acetic acid to cause it to flow smoothly.—J. W. BLACK.

171. Foggy lines or streaks, in the direction of the dip, on negatives often appear after freeing the nitrate bath from organic matter, or strengthening with new silver. I am not aware that any remedy has been proposed for this trouble, except moving the plate horizontally in the bath for the first thirty seconds after immersion, which had scarcely any appreciable effect in my case. I was induced to give this some consideration through having about one hundred and sixty ounces in this condition, although free from organic matter, and sufficiently acid. My other bath working well with the same collodion, I inferred that the bath, having been continually strengthened with a stronger uniodized silver solution for a long time, had not the same amount of iodide in it when it was still further strengthened

172. Another defect is shown in the form of streaks and lines, starting at the lower edge of the plate and extending upward in the form of a triangle. These come from a scum to be found floating on the surface of the silver solution. If the dark-room is kept clean, the bath covered when not in use, and the habit followed of filtering the solution every day or two, this defect will rarely annoy you.

173. Dark, opaque lines running down from the top of the plate are also frequently met with. Unequal or irregular development is their usual cause. If, for any reason, a greater amount of silver is deposited upon one part of the plate than the other, these marks will occur. After

with new silver and cleared from organic matter. I therefore added a few grains of iodide of potassium, and filtered, letting it stand all night. On trying it the following day the lines had entirely disappeared, the negative having all the beautiful bloom of one taken in a new bath. Before the iodide was added, the negatives were thin and weak, without body.—HENRY GREGSON.

The *bath* will never "streak" the plates if the latter are moved about in the solution as soon as dipped, and kept in motion until smoothly coated. This is necessary more particularly when the bath is charged with ether and alcohol. The alcohol mixes with the solution, but the ether rises to the surface and sometimes causes *scum*.—ELBERT ANDERSON.

172. A very common and often unsuspected source of streaks is the presence of scum on the surface of the bath, which, if the room is very dark, is not observed.

There are other causes of streaks and stains, but this is the chief. We mention it that the inexperienced photographer may see the necessity of carefully overhauling the whole of his operations when he meets with any of these difficulties, and not fancy that, by making his dark-room so dark that he cannot move in it without upsetting something, he is forthwith to rid himself of further trouble in this respect.

Nevertheless, too much stress cannot be laid on the importance of excluding all actinic light from the dark-room. The more perfect the working condition of the chemicals, the more dangerous will necessarily be every stray beam of white light.—OLD ARGENTUM.

173. A network appearance on the film after developing, when *universal*, and accompanied by rottenness of film, often depends upon the use of collodion containing water. Or, if not due to this cause, the plate may have been immersed too quickly in the bath, and the soluble pyroxylin partially precipitated. This is very likely to happen when using collodion containing a sufficient excess of alcohol to interfere with the setting properties of the pyroxylin, especially in cold or damp weather.—T. FREDERICK HARDWICH.

Surface stains are a botheration wherever occurring. One great cause is too long a time between the sensitizing of the plate and its exposure to the light; but there are many others. The way to prevent them is what we want to know; the cause we need not care for, though that often rules the cure. The shields should always be kept clean, and a good plan is to interpose strips of blotting-paper between them and the plate. All varnishes which have any action whatever on nitrate of silver should be avoided. In case of long exposure the dark-slide should be wrapped in a thick, damp cloth, and, as far as possible, when the plates must be long kept, use a new nitrate bath, or one nearly new. Very often these stains can be

the developer is flowed over the plate and the image begins to appear, if the plate is held vertically, the developing solution will, left to its own action, form in irregular lines, and carry in its train more silver upon some parts than others, thus causing the uneven development spoken of, and the consequent lines or streaks.

174. The best rule for development, if the exposure has been right, is to proceed with it until the image fully appears, appearing slowly. If the image flashes out immediately upon the application of the developer, thus indicating over-exposure, watch closely until all the details are out, then quickly stop further action by holding the plate under the tap.

175. Lines of a still different character often appear. They form in irregular squares resembling the lines upon the shell of some quaint old

overcome by using in each ounce of collodion, bromo-iodized with ammonium accordingly, a grain of chloride of calcium dissolved in a few drops of strong alcohol; or dissolve twenty-five grains of iodide of magnesium in two ounces of strong alcohol, and add one drachm of this to each three ounces of the collodion.—George W. Wallace.

174. In developing, see that the developer is filtered clear, and flow it over the plate in one even wave. Do not have it too strong, or semicircular lines radiating from the corner will be the result; neither must you have it too weak, or hardness and want of half-tone will be the result. From twenty to thirty grains to the ounce will be about right. Have all your developing clean, and wash both your negative and your hands well after each operation. Finally, fix your negative, wash it well, and dry it. Lastly, a few words on the apparatus. If it is not in good condition, all the trouble spent on chemicals is useless. See, then, that the camera is in the best condition to assist the chemicals to produce the best results, *i. e.*, see that there are no chinks or cracks in the woodwork, nor holes in the corners of the bellows, by which white light is admitted; see that the lenses are clean and covered with a hood to keep out reflected light. Keep it in the dark as much as possible when operating. Having accomplished the above necessary conditions, go to work, pose and light your sitter artistically, and I think you will soon go home at night with a lighter heart and heavier pocket.—George H. Fennemore.

175 The first signs of failure of the negative bath with me are generally a refusal on the part of the silver solution to lie perfectly smooth on the plate after the latter is sufficiently sensitized.

I do not mean that the plate does not coat smoothly, but, after it is all ready and withdrawn from the bath, the silver solution runs down in an irregular manner (*lumpy*, I call it), and the plate takes rather longer to sensitize than usual. Cause: Too much ether and alcohol in the bath. Remove the bath and test for strength. (I frequently run mine down as low as twenty-five to thirty grains, and produce as good effects as at forty.) Boil about *one-third* its volume away, let cool, add water enough to make from thirty-five to forty grains, filter, and you are all right. One hundred more plates may now be dipped before the next signs of failure present themselves.—Elbert Anderson.

Now, in order to get delicacy in our picture, reduce the strength of iron on the plate by adding water, and an entire change takes place; the silver deposits finely over the entire

tortoise. These arise from ether and alcohol being present in the bath, which cause the nitrate of silver solution to run into lines after taking the plate from the bath, and also prevent the developer from flowing smoothly over it. The remedy is, to boil the bath down about one-half, and add fresh rain-water or distilled water until it is the proper strength again, after which filter and it is ready for use.

176. The developer causes other troubles. Occasionally it will be seen on a negative that, at the lower right-hand corner, there is a large semi-transparent spot, and from it lines radiate in a curve all over the plate.

exposure, softening the strong outlines in contrast, and giving a roundness and delicacy not possible with one strength of iron.—S. P. Wells.

Try my method of pneumatic development. By its use the details are developed quicker and with more clearness, and designs produced whereby lights and shades are brought out. This method consists in the following operation: Take a small india-rubber ball, with tube attached to it, and direct a current of air on to the deep shadows. By this operation the collodion film becomes more sensitive, and the development goes on more quickly, whereby greater precision and distinctness are given to the details.—Ernest Kreuger.

Keep a saturated solution of iron on hand. For use, reduce to fifteen grains, by hydrometer, the quantity required for a day's use; acetic acid, one ounce to twelve ounces of the fifteen-grain solution. If my bath is new, I don't use any alcohol unless it gives too strong a contrast. By adding one-half ounce or more of alcohol it will work softer. I think the adding of acetic acid just before you use it, works better and quicker; but if the negatives lack vigor, I think that an older developer will work better; also for copying. So it is a good plan to have some old on hand. Sometimes the best effects can be had by mixing old and new. I sometimes add a few drops of acetic acid to the developer just before I use it; I find that it has more to do with results than many are aware of. I have tried a great many articles in connection with the iron, but I believe that one can work more sure and get as good results without any of them.—A. W. Kimball.

176. The developer flows in a greasy manner: 1. From the bath being old, and containing much ether and alcohol. In this case a purely aqueous liquid is not capable of flowing at once over the film, and a portion of spirit must be added to the developer. 2. From use of too much spirit in the developer when the bath is newly made, and nearly free from alcohol; if the surface liquid of the film is entirely aqueous in character, the developer should be aqueous also. The developer refuses to wet certain parts of the film, and will not flow up to the edge. A gelatinous collodion often repels the developer, and especially so with a newly-prepared bath. Old baths, containing ether and alcohol, render the surface of the film less gelatinous, and remedy the defect. The plate should not be dipped too quickly, or the difficulty will be increased. Acetic acid and spirit, added to the developer, are serviceable. The stronger the alcohol in the collodion the more marked the defect. In hot weather when large plates become partially dry and repel the developer, redip them in the bath, or use a developing solution greatly diluted with water.—T. Frederick Hardwich.

Of developers I cannot say very much, except to strongly recommend adding glycerin instead of alcohol, or using half alcohol and glycerin when the bath is greasy. Glycerin gives such a command over the development, allows for such deliberation of treatment, and

That indicates that the developer has been too strong, and without sufficient acid in it; that it was also carelessly applied,—instead of flowing it over evenly, it was thrown over with a dash, causing the spot in question. The danger of spoiling your negative is not over when exposure is made. Many troubles arise with the developer. When the iron is too strong, and without sufficient acid to restrain its action, it causes an unequal reduction of the silver, which produces the ugly markings just now mentioned.

177. And there are still more kinds of defects constantly occurring to mar the peace of the working photographer. They are, as a general thing, however, resultant from heedless manipulation, and may be avoided if the proper care be taken, and your purchases are made from a reliable dealer, whose prices are fair enough to keep him from the practice of adulteration. While chemicals are exceedingly obstreperous, they *can* be kept in comparatively good order if they are given the attention laid down in the rules. Knowing the causes of defects, then, it should not be difficult to avoid them.

has all the exquisite flowing qualities of gelatin, without the retarding effect on exposure, that once an operator gets used to its easy manipulation he will never go back to the simply alcoholic developer. For indoor working, I use fifteen grains of protosulphate of iron to one ounce of water, and for outdoor work from five to ten grains. Acetic acid is added according to time of year, kind of subject, and quality of light.—ALFRED HUGHES.

177. OILY LINES.—1. Lifting the plate out of the nitrate bath before it has been immersed sufficiently long to be thoroughly wetted, or before the ether upon the surface has been washed away. 2. Redipping the plate in the nitrate bath after exposure in the camera, and pouring on the developer *immediately;* if a few seconds be not allowed for the purpose of draining off the excess of nitrate, the pyrogallic acid will not readily flow over the film. 3. From too small a quantity of fluid having been employed to develop the image. In this case, the whole plate not being thoroughly covered during development, the action does not proceed with regularity. 4. Opaque, oily, diagonal markings are very commonly produced by pouring off the developer, and examining the plate by transmitted light, without washing the film; the solution of pyrogallic acid runs into lines which show after fixing. 5. Addition of old collodion in making a new bath. The ether mixes with the bath and gives a greasy appearance to the immersed plates.

TRANSPARENT MARKS LIKE CURTAINS.—These occur at the edge of the plate which is most depending in the camera, and are produced by the bath solution draining down, or sometimes ascending by capillary attraction, from the corners of a dirty slide. They are most common with a gelatinous, simply-iodized collodion, and are seen in cold and damp weather more than in hot and dry weather. To obviate their occurrence, allow the ether to evaporate from the film before dipping, so that the bath solution may run completely off; or turn the plate round, that the upper and dryer part may be below; or place it across the dipper so as to bring the curtain mark to the side of the picture, where it will be less visible.
—T. FREDERICK HARDWICH.

178. A generally wretched negative, that seems to possess all the ills which occur in negative-making combined, will look thus: In the first place, it is full of pinholes and large streaky patches of white scum, as if somebody had poured a solution of chalk and water on it; secondly, the film is thin, and the image harsh and without detail; in fact, destitute of a single good quality. First, there are two distinct kinds of transparent spots; one kind is called pinholes, caused by a large excess of iodo-nitrate of silver in the bath, and the other kind is specks of irregular shape, such as are caused by dust, sediment in the collodion, etc.; then there are the large white patches, spoken of above, which indicate that the plate-holder is very dirty, and that, the plate not being properly drained, the silver has run down, absorbed the deleterious matter, and has again been drawn up by capillary attraction and settled upon the plate, adhering to it with great tenacity. In addition, that the bath is full of ether and alcohol, is shown by irregular greasy markings which are all over the plate; finally, the image is hard and chalky, and lacking detail, proving that the col-

178: Pinholes may be formed in five ways: *First,* dust; *Second,* unsettled collodion; *Third,* over-iodized bath; *Fourth,* too strong iron solution; *Fifth,* over-iodized hypo. All of these have a different and distinct appearance.

1. Pinholes from dust are irregular, as regards size, and scattered irregularly over the plate. The remedy is obvious. 2. Pinholes from unsettled collodion are very numerous, and regularly scattered over the entire plate. Upon examining them, however, with a microscope, they will be found to have little tails attached to them, which indicate at once the source from which they arise. 3. Pinholes from an over-iodized bath are very numerous, scattered evenly over the plate, are sharp crystals without tails, and leave a clear spot on the glass after fixing. 4. Pinholes from too strong iron solution are caused by the precipitate of oxide of iron; they have a close resemblance to those of an over-iodized bath. 5. When the hypo. solution has dissolved as much iodide of silver as possible, it will be saturated, and, after a short time, will deposit fine crystals of iodide of silver on the plate. In this case, however, these may be detected by there being no signs of pinholes until after fixing. If there should be any doubt as to whether the bath is near a point of saturation with iodide of silver, you may easily determine the state of the bath by the following experiment: Into four ounces of water pour gradually four ounces of bath solution, and watch narrowly the time when the precipitate of iodide of silver takes place. If you can add nearly the whole amount of the bath solution before the milky precipitate takes place, the bath is far from saturation; but should this precipitate take place before much addition of the bath solution, continue to add the four ounces of solution, and stir the mixture thoroughly. Next add crystals of nitrate of silver gradually, stirring until dissolved. When the mixture just clears, and no more, test with your hydrometer, and you will see at once the state of the bath. If the hydrometer marks thirty grains, or nearly thirty grains, the original strength of the bath, your bath is *nearly* saturated; but if the hydrometer mark only twenty grains, or less, you need not fear pinholes from over-iodizing for some time to come.—ELBERT ANDERSON.

lodion is old, red, and insensitive, or that the bath is highly charged with acid in the vain endeavor to get rid of fogging, or perhaps both.

179. The authorities do not always agree as to the cause of these annoying spots, and sometimes their appearance is so mysteriously sudden and so persistently continuous as to baffle even the doctors of photography themselves. It is often serviceable, when such annoyances occur, to go back mentally and think over what you have done, and mayhap the cause of your annoyance will come to you. The causes of *this* annoyance, at least, are well laid down in the notes.

180. There is this one agreeable thing about photographic manipulation, however: the chemicals, *under certain conditions*, are pretty sure to

179. The following are frequent causes of spots on the collodion plate. *First.* Newly-iodized collodion. 1. Containing bromide of potassium in quantity more than the collodion will dissolve; in this case the spots will be round and transparent, thickly studding the plate. Allow twenty-four hours to subside, and draw off the upper part. 2. The collodion is free from undissolved particles of iodide, but contains a fine sediment of pyroxylin; specks from this cause are extremely minute and abundant. Three or four days' setting will clear the collodion; but very often the specks will disappear if a portion of a more intense collodion be mixed with the newly iodized. 3. The collodion is free from suspended iodide or undissolved pyroxylin, but, nevertheless, the plate shows transparent specks. In this case, the specks may be due to dust, but the remedy last given is the most likely to prove successful.

Second. Faults of the bath. 1. Newly made from impure nitrate of silver. In this case the image will be very weak as well as spotty, and the bath will require a trace of acetate. 2. Iodide of silver, previously dissolved in the bath, crystallizing upon the film. The film, in such a case, exhibits little projecting points upon the surface of the iodide before exposure in the camera, and transparent pinholes after fixing. Add to the bath a sixth part of a thirty-grain solution of nitrate of silver, not containing any iodide of silver, and remove the plate from the solution after an immersion of two minutes. Or, leave a sensitive plate in the solution all night, that the excess of iodide of silver may gradually crystallize upon its surface, and so be removed. 3. A floating film of iodide of silver upon the surface of the bath. These spots are not universally distributed, and are larger than the last. Remedy: Change the collodion or the time of dipping. 4. Deposits of reduced silver on the sides of the bath and dipper, or fragments of iodized collodion which have fallen into the solution. Spots so produced are easily recognized, and the appearance of the picture at once shows that the bath requires filtering.—T. Frederick Hardwich.

180. To Find the Cause of Pinholes.—Pour one ounce of the bath into a glass graduate, and add, slowly, a drachm at a time of pure water to the solution. If, on adding one or two drachms of water, the solution turns milky, the holes are caused by an excess of iodide, which at once remove by pouring your entire bath *into* an equal quantity of pure water, allowing the iodide to settle to the bottom, and filter, and either boil down the bath to forty grains per ounce or add new silver. If, on the contrary, you can add from one to four ounces of water, and the solution does not turn milky, the pinholes are caused by a lack of

behave handsomely and satisfactorily. Knowing these conditions, then, obey them, and your results will be what you desire. If they are not, *there is a cause*, and the sooner you think it out, look it up, and eradicate it, the sooner you will "be happy."

181. Blueness of the film after immersion in the nitrate bath sometimes occurs. This may be caused by a bath too strong for the collodion; a bath not iodized sufficiently; too cold a temperature (your dark-room

iodide; then add more to the bath. Plate-holders, tablets, and cameras, as well as your bottles and shelves and floor of the dark-room, must be wiped damp every day.

As the remedies in all of the above instances are very obvious, I will only give the treatment for removing them from an old weak bath. Say your bath is a twenty-ounce one, pour it into twenty ounces of ice-water; a canary-colored, cloudy precipitate will be the result. Allow it to settle, then filter the solution clear. You may now either add to it two ounces of nitrate of silver, or boil it down to twenty ounces of solution, when it is again as good as new. The above treatment will restore a badly-working bath almost without fail. If it does not, waste no time, but make it into a printing-bath by neutralizing the acid in it with ammonia; the iodide remaining in it may or may not be removed, as it does not seem to affect the tone of the prints.—C. A. ZIMMERMAN.

My process consists in adding five drops of chemically-pure hydrochloric acid to every hundred ounces of the bath, and stirring it thoroughly for some time, then filtering it. By this means the excess of iodide of silver will combine with the chloride of silver, and, throwing it down, leave us a bath that will give clear negatives without any of the so-called pin-holes. For every drop of hydrochloric acid added to the bath an equivalent amount of nitric acid is set free, probably rendering the bath too acid. In order to neutralize the acid and bring the bath to its original strength, the best way is to add carbonate of silver, which is taken up by the nitric acid, setting carbonic acid free, and forming again nitrate of silver. In order to prepare the carbonate of silver in a simple way, add a solution of chemically-pure carbonate of soda to a solution of nitrate of silver so long as a precipitate is formed, which is to be thoroughly washed and dried at common temperature. I use the carbonate of soda in preference to the carbonate of potassa on account of its being more easily obtained in a pure state.—J. TRAILL TAYLOR.

When my bath becomes charged with alcohol and ether, but works well otherwise, I pour it into a bottle containing one-third its bulk of water; filter, neutralize with liquid ammonia, and pour into an evaporating-dish, and boil down to its original strength. Filter, and add nitric acid sufficient, and it is ready for work again. But if the bath has become contaminated with organic matter, it will be best to boil it down and fuse it; then redissolve in purified water, acidify, and it generally works better than a new bath. Keep three or four baths on hand, and while you are working one have the others in the sun, after being first treated as above.—J. A. W. PITTMAN.

181. One of the great secrets in making nice, clean negatives, is to keep your chemicals at an even temperature both winter and summer; and in order to do so, make a wooden box, or, better still, have your tinner to make you one out of galvanized iron, large enough to hold your baths, having a V-shaped trough back of the baths for the receptacle of ice in summer, and made so as to lift out in order to empty the water in the morning, then replace

should never be below 55° or 60°), and, also, by too thin or old and insensitive collodion.

182. Black and White Negatives without Half-Tones.—Such are caused by under-exposure; by the contamination of the nitrate bath after long use; by using a collodion that is too old and red; too much acid in the negative bath; too strong a developer; and, finally, by boiling your nitrate bath to fusion. A great many recommend this latter method to get rid of organic matter in the bath, and yet so few know how to do it properly. If it is fused beyond a certain point, solarization of the negatives is sure to result, and you get chalky whites and deep blacks without detail or half-tones.

183. Flatness and Want of Contrast.—This may be caused by over-exposure; by using too large a quantity of developer, thereby washing

and add ice for the day; the whole to be covered with a top hinged just back of the baths so as to open both ways—one part to cover the baths, the other to cover the ice-dish. Then the door in front is made so that you may utilize the space under the front of the baths for your collodion and developer; consequently, you have your bath, collodion, and developer all of the same temperature in summer.—Frank Thomas.

At night, when all work is ended for the day, I take my heater to the stove and carefully put a couple of shovelfuls of hot ashes out of the stove into the heater, put on the cover, wipe off any superfluous dust, carry it into the dark-room, and stand the whole thing in the middle of the room on three clean bricks, and in the morning I repeat the operation (leaving the old ashes in the heater, and only taking them out to make room for fresh, but always leaving some in), and my dark-room, after the usual cleaning, is ready for business, and will keep evenly warm until night, as the ashes hold their heat a long time, and are almost as hot at night as when they were put in in the morning. It is a very cheap contrivance and answers admirably, entailing no expense, and being free from disagreeable smells, like coal-oil stoves emit. It will last a lifetime. I made mine myself out of an old five-gallon oil-drum, and any handy man can make his own.—L. A. Weller.

182. When a negative is under-exposed, it will look much like an ambrotype; it is black and white, and generally too intense for a good picture. An over-exposed negative is just the reverse; you can hardly see the image when looking at it by reflected light. Prints from it are flat and gray, face and drapery being nearly of one color.—G. H. Fennemore.

I suggest that when a bath ceases to work well, it is not worth while to waste much time in coaxing it. Success is doubtful, and, if a single trial or two does not succeed, it is better to turn the bath into a bottle, and make a new bath. It is no waste of material, and considerable saving of time and patience.—M. Carey Lea.

183. The introduction of iron for development has almost entirely changed the method of working, and now the rule is to employ a much weaker printing-bath and use subdued light instead of sunlight. The time, however, necessary to produce a print is very nearly the same, notwithstanding the very thin character of the negative as compared with the old ones. I do not, however, wish it to be understood that I consider half a day needful for the

off most of the free nitrate of silver, or by using too new a collodion; by plates remaining too long in the nitrate bath; by too much time intervening between the removal from the bath and the development, and by the use of too much bromide in the collodion.

184. An Apparent Formation of Network after the Film is Dry.—This may be caused by using alcohol that is not absolute, and therefore containing too much water; or, if you use potassium salts for iodizing or bromizing, you may use too much water in dissolving them. It is sometimes caused also by impure ether. Crapy lines are formed by the collodion being too thick; in which case thin it down with iodizing solution. Sometimes they result from the collodion being too gelatinous; in that case add some old limpid collodion to it.

185. There are two other negative trials which are apt to occur, and which are too important to be overlooked. One of these is known as

production of a print from an average negative of the present day. The experience of many will, however, bear me out in saying that from negatives yielding, in summer, prints full of gradation, the results at this time of year are totally different, and that hardness is the rule; whilst from many negatives that printed respectably in bright weather, presentable results cannot now be obtained at all. On the other hand, many negatives that in very bright weather, even in the most shady street possible, gave flat, poor prints, are now found to yield perfect results.—Valentine Blanchard.

184. A great number of experiments have recently been made in order to discover the best method to adopt in the chemical laboratory to detect the presence of water and alcohol in commercial ether. After many trials it appears that the old method, which consists in washing the ether, is, after all, the best. A given quantity of the sample is put into a finely graduated tube; the volume is noted; the same volume of cold distilled water is added; the tube is corked to prevent a loss of ether by evaporation, then the whole is shaken, frequently reversing the tube. When the ether contains alcohol, this last is dissolved in the water; the column of ether which rises to the top is measured with care, and the difference between it and the original volume represents that of the alcohol and water contained in the sample. As ether is slightly soluble in pure water, the results are a little too high. In reality, one hundred parts of water dissolve ten parts of ether, whilst the same quantity of water dissolves an indefinite quantity of alcohol. To be exact, allowance must be made for the quantity of ether which may have been dissolved in making this little experiment.—Dr. Phipson.

185. Should the "lighting" be correct, and the bath yield harsh or black and white plates, it can be from two causes: 1. Insufficient time of exposure. 2. Insufficient iodide in the bath. Should the *latter* be the cause, coat the largest plate the bath can take on *both sides* with collodion, and leave it in the solution over night, or at such times when the bath is not in use.—Elbert Anderson.

Where I know that the negative has received too brief an exposure, I expose to the gaslight, regulating my development carefully according to the result; and here (in the

density. Negatives afflicted with this are a trouble to the printer, and the prints made from them are usually of an indifferent character. This fault may be in a measure cured by the employment of a reducing process, which is always one which requires the nicest care and a knowledge beforehand of the quality you desire to secure.

186. The second trial alluded to is known as "weakness" of the films, and is caused most generally from *over*-exposure. A bath too strong for the collodion used, or a bath that is weak; collodion insufficiently salted,

development) we have a wonderful power if we observe closely. Then, again, in intensifying, we possess another power of modifying the resulting picture; so that, with care and judgment, by the secondary exposure, a negative that has had insufficient time in the camera may be made to give a fairly-good print instead of being rejected. There is not a photographer, I suppose, who is not fully alive to the importance of keeping the chemicals at a suitable temperature during cold weather, and there is no way so good as having the dark-room continually warm both night and day.—Alfred Hughes.

This method of reducing the intensity of the negative has reference only to that class of negatives which is produced by under-exposure, too strong contrast of light and shadow, collodion too thick, or bath too acid, where the high-lights are so dense that the negative yields only white and black, hard, chalky prints. In such cases pour over the negative, after the fixing solution of hypo. or cyanide has been washed away, a very dilute solution of perchloride of iron. Allow this to act on the deposit of the high-lights until a slight change of color takes place, then well wash and pour over again the usual hypo. or cyanide fixing solution. The dense deposit on the high-lights will be found to be reduced in intensity proportional to the action of the perchloride of iron solution. The best advice I can give is to bear in mind the principle of the chemical change that takes place. The original dense deposit forming the high-lights of the negative is composed of metallic silver; this is not soluble in either hypo. or cyanide. By pouring on solution of perchloride of iron, the outer layer of the deposit is changed into chloride of silver, and chloride of silver is very soluble in the fixing solution. If the perchloride solution be allowed to remain on too long, all the silver forming the deposit will be changed into chloride of silver, and will all be dissolved away. This is clearly doing more than is required; the real point to be gained is to dissolve away only that excess which renders the negative too dense. The whole operation is a delicate one, and requires quite as much judgment to be exercised as in developing or intensifying a negative. It is really a process exactly the reverse of intensifying; but there is this difference—that intensifying is usually done at one operation, and the process can be observed as it proceeds. In this, however, the real action is done by the perchloride, and the exact amount of the action cannot be told until the fixing solution is employed to show the change that has taken place. The greatest care is, therefore, necessary in using the perchloride, otherwise a negative may be injured instead of being improved—Jabez Hughes.

186. A correspondent of the *Philadelphia Photographer* says: "As the tendency of all intensifiers is to flatten and destroy the beauty of the photograph, it is desirable to omit them as much as possible. I often avoid their use by the following 'dodge.' If, after the negative is developed, fixed, and washed, it needs a little reinforcing, I dry it rapidly by the stove or otherwise, which usually brings it right for printing. Any one who will try the experiment

and insufficient immersion of the plate in the bath also cause thinness or weakness of the film. This class of negative is the easiest to make, because it allows the most latitude for the careless, heedless, slovenly manipulator. In such cases resort is had to intensification, but in it, also, trouble occurs, unless care be exercised. Formulæ for intensifiers are given at page 106. Here only the troubles of it are treated.

187. All who have the patience to make portraits of children a specialty, know the value of an intensifier close at hand. In such extreme cases it is excusable, but as a habit it is uncalled for. In making copies, too, where sufficient printing density cannot otherwise be had, resort is had

will be surprised at the difference between a negative thus dried and one that is allowed to dry spontaneously. Negatives, after washing, should be flowed while wet with a solution of gum-arabic in water. This prevents the hard varnish from changing them."

It often happens with an under-exposed negative that it is desirable to intensify only certain portions of it, as, for example, a portrait in which the hands and face would be completely spoiled before the other portion obtained sufficient density. With careful manipulation, the following dodge will be found useful: After development, stand the negative on end to drain, and when half dry—*i.e.*, when it has lost its watery appearance—hold it over a tiny gas jet, allowing the flame to come and the drying to commence in the centre of the face. Have the water ready to hand, and, when the small dry patch has extended to the edge of the face, dash the water over the negative. The intensifying may now be proceeded with, and much of the detail in the features will be saved which would otherwise have been lost.—R. V. Harman.

The chief defects that arise through intensifying are those which may also occur in development. Fog and a red deposit are chiefly to be anticipated. The former may occur before fixing if the pictures be over-exposed; the latter, both before and after fixing, by the addition of too much free nitrate of silver to the intensifier; or again, after fixing, by the imperfect washing of the film before the intensifier is applied. The red stain will often yield to treatment with a solution of acetic acid and water (half to half). It should be noted that the larger the amount of silver added the more rapid will be the intensification; but the half-tones will not be brought up proportionally to the high-lights. The smaller the quantity of silver used, the greater will be the comparative force given to them, and the longer time it will take. Thus, a negative lacking in contrast may be corrected by using an intensifier with large, and one too rich in contrast with small, doses of silver. When the mixture of pyrogallic acid and silver becomes turbid, it must be rejected, and a fresh solution poured on. Sometimes a bluish precipitate will form in the shadows; when this takes place, it is an indication that the intensifier is not sufficiently acid. Intensification with iron is equally as rapid as with pyrogallic acid. When using the former, however, it is necessary to use about twice as much silver. With landscapes and portraits, intensifying is comparatively easy work. With reproductions of drawing, plans, or manuscript, it requires more time and great care. The fine lines become easily veiled or the plate unequal.—J. L. Gihon.

187. Permanganate of potash is much used, but concerning it, one thing, however, can be said, namely, that it lacks force in its operations upon a negative, does not thicken, as it were,

to intensification. There are many methods of procedure in this line, some acting with the delicacy of a jeweller's tool, while others possess the power of a veritable sledge. Thus all sorts of effects are obtainable.

188. As will be observed, some methods of intensification secure only a change in color of the negative, while with others an actual chemical change is caused in the films. Experience will teach the manipulator

but merely changes the color of the deposit. This, I have found, can be entirely obviated by adding bichromate of potash. My formula is:

1.—Permanganate of Potash,	5 grains.
Water,	1 ounce.
2.—Bichromate of Potash,	10 grains.
Water,	1 ounce.

These solutions are made up and kept separate, being mixed in equal proportions when wanted. It is exceedingly useful for intensifying a negative of a baby which has been much under-exposed, or for enlarged copies or negatives of line engravings for silver printing or photo-lithography. The improved intensifier is used after fixing, and after the negative is strengthened and washed it should be flowed with a solution of gum-arabic. In some instances it is not advisable to varnish, but print with care without varnishing.—DAVID DUNCAN.

I claim to have originated this intensifier. The formula is as follows:

1.—Hydrochlorate of Ammonia,	1 ounce.
Bichloride of Mercury,	1 "
Distilled Water,	20 ounces.
2.—Chloride of Gold,	1 grain.
Distilled Water,	1 drachm.

To make the intensifier, put two drachms of each solution into a four-ounce bottle and fill up with water. A small quantity of this should be poured rapidly over the negative, from a glass measure, and kept moving upon the surface in the usual way until the necessary density is obtained. If it has lost its yellow color, and become white when returned into the glass, it should be thrown away, and the operation, if incomplete, must be continued with fresh solution. I may add that there is yet another and not unimportant merit in this intensifier. A small quantity applied to the film of a well-exposed and fully developed negative will enable you to view the portrait *through* the glass, and then it has the appearance of a very delicate and beautifully shaded positive, thus permitting the sitter to judge at once of the likeness, expression, etc. In the case of a *very* thin negative, the intensifier may be followed by a *weak* solution of iodide of potassium—half a grain to an ounce of water.—J. A. WINTER.

188. Perchloride of iron is a salt easily obtainable in commerce. It is very deliquescent, very cheap, and a little goes a long way. My method of using it is thus: I make a stock solution of, say, ten or twenty grains to the ounce of water. This makes a dark, cherry-colored solution. At the time of using I add a few drops of this solution to an ounce of water in a measure-glass. This dilute solution should not be darker than a pale golden tint. I pour it over the well-washed plate and watch the change. In a few seconds the deposit forming the high-lights changes very slightly from its drab color to a pale ashy hue. I then wash it off well, and

which to choose in time of need. Knowing how far short the negative in hand comes from being desirable in every way, he must select the means of recovering it which will be the surest, as he would select a tool were he a mechanic. The perchloride of iron, perhaps, acts with most certainty and is the easiest to manage, though it is largely a matter of choice.

next pour over the hypo. solution used for fixing. This dissolves away the thin layer that has changed color. I wash well again and examine the negative to observe if sufficient deposit has been removed. If it has, the operation is complete; if it be still too dense, I repeat the operation with the perchloride and the hypo. as before, well washing between the operations. If the perchloride be too strong, or has been left on too long, the negative will be found to have been reduced too much, and recourse must be had to the usual intensifying process to recover what has been lost. This, however, is not nearly so desirable as reducing only to just the desirable extent. I should mention that this method leaves the silver in a spongy state that is easily penetrated by the varnish; it is better, therefore, rather to under than overdo this reduction, otherwise the negative, when varnished, will be too weak in the high-lights. I rarely reduce my negative by only one operation of the perchloride and hypo., but I generally use the solutions alternately two or even three times, and thus gradually approach my result, it being very difficult, especially if there be much density, to exactly estimate the influence of the perchloride solution. In this method it is best to experiment on a useless plate or two. At first most persons will either carry the process of reduction too far, or will not carry it far enough. I know few processes requiring more judgment in its use than this one, but it is really at times so useful that all photographers should be acquainted with it. By its employment many otherwise useless negatives may be made to produce passable prints. It can be used advantageously to reduce the intensity of a negative in local parts. It may be poured on hands or foreheads, shirt-fronts, white skirts, or similar parts that are relatively too dense. I use a dropping-bottle with a fine orifice, and, holding it close to the plate, pour on a fine stream to just where I want to localize the effect, washing instantly the solution away before it sensibly acts on the adjoining parts. This I repeat two or three times in succession, washing between, when I have a small part—say the side of a face, hands, white gloves, or handkerchief—prior to using the fixing agent.—JABEZ HUGHES.

The ferridcyanide of potassium system is also very valuable, but the chemicals are rather more difficult to obtain. I had often admired the negatives produced by Dr. Maidstone Smith, of Bath, sent to me for enlargement, and he has kindly given me his formula, which works admirably, the only drawback being a slight liability to stain; the increase of power is obtained solely by change of color, and, as in the above, the solutions keep permanently.

1.—Persulphate of Uranium,	1 drachm.
Water,	6 ounces.

And, in a separate bottle,

2.—Ferridcyanide of Potassium,	1 drachm.
Water,	6 ounces.

Take a drachm (according to size of plate) of number one, and flood the plate whilst wet; pour back to the measure, and add number two, drop by drop, and work over the plate. It is the latter that gives the intensifying power, and it must be slowly added; the intensity is gradually given, and the result very beautiful. Which of these two systems is preferable I

189. After the negative has run the gauntlet of all the preceding troubles it must be varnished, as has already been stated. (See page 114.) It is then entrusted to the tender mercies of the printer, who, if in sympathy with the manipulator, will secure from it the best possible results. He is not always careful, however. The negative that produces the best results is the most used, and often the most abused. The varnish becomes full of dust and specks which are allowed to fall upon and become imbedded in it, and it must be removed and the plate revarnished. Or it may be that the negative is no longer serviceable, and it is required to remove the film in order to use the glass again.

really find it difficult to say, both are very good; and I fancy the composition of the image equally good in either case. Such negatives, when varnished, are as smooth as the glass itself.—SAMUEL FRY.

I read of a man whose health suffered from the use of intensifiers. Why use mercury, sulphuret, etc., when iron will do the work quickly or slowly, as you choose to have it? Beside it works very effectually. Below is a formula for which I am indebted to the editor of the *Philadelphia Photographer;* since using it I have had no trouble in getting all the intensity I want. If it turns muddy, increase the dose of the acid a little. Here it is:

Sulphate of Iron,	1 ounce.
Citric Acid,	½ "
Water,	1 quart.

Use either before or after fixing, as you like best, with a few drops of silver in it just before use, as in case of the pyro. intensifier.—RANALD DOUGLASS.

189. Many methods have been suggested for removing the varnish from old plates. A mixture of benzine and alcohol in equal parts, agitated and poured on the plate, generally acts very quickly and very well. The last traces of reduced silver which may yet adhere are then removed by iodized alcohol (alcohol 100, iodine 0.50). When the surface is properly cleaned, it is rubbed over with the finger or a tuft of cotton lightly impregnated with tallow, and wiped dry. Plates thus prepared may be kept indefinitely, and are protected from dampness, the enemy which too often imposes itself between the collodion and its support.—ELBERT ANDERSON.

Fill a large, flat, and deep porcelain dish with as many old negatives as it will hold, or that you may wish to destroy, so overlapping their edges or placing them that there will be a small space between the surface of each of the plates. Then pour upon the entire batch sufficient commercial nitric acid to entirely cover it. *Add about four ounces of strong alcohol to each quart of the acid.* No action takes place immediately; but in about ten minutes ebullition commences, and dense noxious fumes will be violently emitted. In an incredibly short time collodion skins, protected by the hardest and most impenetrable varnish, will entirely leave the glasses, and they are ready for a slight washing, albumenizing, and further use. It is scarcely necessary to suggest that the dish should be placed in the strong draught of a chimney, or in the open air. In half an hour you can more simply and effectually cleanse more old negatives than by days of treatment with alkalies and acids used in any other manner.—JOHN L. GIHON.

Cover the bottom of a dish with the negatives, face upwards; pour oil of vitriol (sulphuric

190. Another sort of carelessness also causes trouble with the varnished plates. If they are kept in a damp place the film will rise up and form inequalities, which, when pressed upon, burst, and the plate is ruined—checkered hopelessly to all appearance. Again, rents occur in the film, resulting from dirty plates as well as dampness. Often a valuable negative is brought out from the rack, where it has been stored for some time, looking pitiful enough. Sometimes racking it away in a cold place, while it is still hot from printing in the sun, will cause such defects.

acid) on the top of one, in quantity equal in size to a half-crown. Then place another negative, face down, on the acid. It will soon spread itself all over between the negatives if sufficient is added, and the dish level. Now do the same to all the other glasses lying on the bottom; after which, another layer, face upwards, and another, face downwards, with acid, of course, between them. The varnish is removed almost instantly, and the plate left chemically clean. When the dish is full, tip it up, and pour off the excess of acid into another bottle until it ceases to run in a stream, but not longer. The acid is now black with the charcoal from the decomposed organic matter on the plate. This used acid is the first to be employed on the next occasion, but requires a little more to be used, and allowed to rest an hour or two after the excess has been poured off as before directed. The next thing to do is to upset the dish in a pan of water, separate the glasses, and rub their surfaces with the hand under water, and then let a little stream of clean water play on both surfaces for half a minute, and stand up to drain. There is no danger of the acid injuring the fingers under water, nor is it liable to splash when being poured on the plates—it is too oily for that. This acid is far more rapid than nitric acid, gives off no corrosive fumes, and is very cheap. The bottle ought to have a stream of water played over it before put aside, so as to be clean and dry for the next occasion. I never get a dirty plate by this means.—T. S. Reeves.

190. When the film blisters, the plate should be laid, varnished side downwards, upon a vessel filled with equal parts of ether and alcohol, when the film would be softened and lie down again flat. The varnish might also be removed by dissolving it at once with alcohol and potash, but that often displaced and injured the collodion film.—Herr Criefelds.

Rents in the varnish of negatives may be removed thus: I had been frequently troubled by worm-like rents in valuable plates, and tried a variety of ways of removing them. With powder I got no good results, nor with rubbing in black with oil of turpentine; indeed, that sometimes loosened the film. I now always use a little dust from a corner of the studio, rubbed in with a piece of wadding. Of course, when the rents are wide they must be filled in by retouching. Herr Brischke used powder scraped off lead-pencils.—Herr Criefelds.

Some are inclined to attribute the cause to dampness, others to dirty plates; but my experience has, I think, exposed the real fact that, air dry or damp, plates dirty or clean, an abrupt change of temperature is the guilty worker of the damage. I remember on one occasion (which, by the way, prompted my study of the subject) taking a quantity of negatives safe and sound from the storeroom over night, preparatory to printing from them on the following morning; but, when that morning dawned, on going to the box I found that mischief had preceded me, and had worked ruin in shapes labyrinthine and fantastic. The lesson was imparted in brief; but I quickly learned the necessity of transferring negatives at once from the storeroom to frames when their removal happened in dull winter. The

191. And now, having piloted your negatives safely across this wide sea of troubles, do not forget that there are one or two things that may give you personal trouble, and even cause your death if care is not exercised. The first of these is from the use of cyanide of potassium. It can be entirely and utterly dispensed with, and it *should* be. But there is a perversity about the photographer, also peculiar to human nature, which causes him to employ means to secure his results in his own way, despite the many drawbacks pointed out by others. Hence a note further on on this.

better plan, however, of avoiding the danger is, doubtless, that which would make such accidents less liable—better still, impossible.

Happily, an efficacious remedy lies within reach of every sufferer. They have only to take heed that they be not again ensnared by the fallacious promises of brilliant, crystal-like varnish; for therein lies the secret of the primary cause. Hard and non-elastic, the varnish film refuses to budge when the glass expands under pressure of heat, or contracts when exposed to extreme or, as it sometimes happens, even moderate cold, and the fruits of that stubbornness consist either in the varnish coat separating into transparent, hair-like lines or in rising in marbled ridges—in either case dragging along with it the collodion film, and thus ruining the most valuable negative beyond the chance of redemption. Varnishes that yield a hard, *brilliant* surface at all times are indicative of danger, and, as such, suggest the propriety of modification—either by adding alcohol to reduce the non-yielding body to subjection, or by an addition of an elastic gum, such as gum frankincense, to induce pliability. —W. T. Bovey.

191. Whenever an accident occurs from imprudent use of cyanide, such as sometimes happens from an operator placing his chapped or otherwise broken hands into cyanide solution, the first thing to be done in case of giddiness or faintness, is to wash the wound in a saturated solution of chlorine at an ordinary temperature. The patient should also immediately swallow two or three grammes of the same solution in a glass of water, without waiting to put sugar in it. He should be at once put to bed, or on the nearest couch, and covered up with warm blankets, hot-water bottles being placed at his feet and along the whole length of his body. The windows are opened everywhere to secure a good circulation of outdoor air, for plenty of pure air is as necessary as warmth in such cases. Tea or coffee is now prepared, and the patient receives a cup with ten drops of laudanum and one or two spoonfuls of any alcoholic liquor, such as rum or brandy. This dose is repeated three or four times, at intervals of from fifteen to thirty minutes.

In cases where the symptoms are very severe, or where the poison has been taken internally, in addition to the above precautions, the dose of chlorine should be five instead of two or three grammes.

The patient should be allowed to inhale frequently from a vessel containing chlorine water. Every five minutes a teaspoonful of the following potion should be administered:

Chlorine Water, ...	5	grammes.
Chlorohydrate of Ammonia, ...	2	"
Sugar Water, ...	250	"

As soon as the patient is better, the laudanum is left out of the tea, and the potion given only once in fifteen minutes.

192 The other affliction general to the photographer is the staining of his hands. As cleanliness is advocated all through his manipulations, when the work of the day is ended he also wants to appear clean. This is laudable enough, but do not use cyanide of potassium for vanity's sake. It is, perhaps, the easiest and quickest means of cleansing the hands, but it is also the most dangerous, and should never be resorted to.

193. Still another evil—and perhaps the most insidious of them all—is the inhalation of poisonous fumes. Photography is not necessarily an unhealthy vocation. There are many veterans in our art who are still

It is well to have the above potion and the solution of chlorine always on hand, and labelled with directions for use. A case of such poisoning may not occur in a gallery once in a lifetime; but still, if it *does* occur, a valuable life may be saved by the prompt use of the above remedies, and on the delay of a minute vital issues may depend.—J. L. Gihon.

192. I have kept silver stains from my hands for the past six or seven years by the use of pumice-stone. Take a piece the size of an egg, and file it smooth on all sides. When through the day's work, rub the hands with the stone under the tap, and away go the stains. I got poisoned with cyanide some years ago, which induced me to try the above, and, until I find something better, I shall stick to the pumice-stone rather than have the silver stick to me.—Well G. Singhi.

Sulphate of soda and chloride of lime, equal parts each. Add just enough water to make a rather thick solution. When about to clean the hands, smear them well with the above. It will not act instantly, but in about five minutes every trace of silver will have disappeared. Wash well in clean water, and after drying the hands rub them over with a little glycerin, diluted one-half with rose-water. This will soften the skin, which the lime is apt to render harsh, and prevent chapping in cold weather.—F. C. Phillips.

193. Many persons are now using the alkaline development, and it is well to point out that if the ammoniacal vapors are allowed to mingle with the air of the laboratory they produce a fog on plates treated by the wet process and developed with the iron salt. To avoid this serious trouble, it is necessary to ventilate the laboratory after having used the alkaline development, otherwise there is a risk of losing the plates which are successively treated there. It is not only necessary to renew the air as much as possible, but to sprinkle a little acetic acid on the floor to absorb the ammoniacal vapors.—Unknown.

The ventilation that is necessary is certainly more than that which would be accomplished by having two or three small openings for the admission and exit of air. Some system should be devised whereby a rapid and constant change of air in these little apartments can be certainly produced, and it never is a difficult thing to accomplish. A tallow candle, lighted and placed in a little flue, or a small kerosene-lamp, in such a position that it will cause a current to pass up through the flue, and out of the laboratory, and a few holes at the bottom, for the admission of air, make a constant and tolerably rapid current to pass through the room, and insure a rapid change of atmosphere; and, certainly, tallow candles and kerosene are sufficiently cheap. The ways of securing ventilation are simply numberless, and no photographer, with a little care of this sort in ventilating his rooms, need ever complain of the harmful effect of fumes and gases. By diluting them with atmospheric air in

living at a ripe old age, and life insurance companies consider photographers quite as good "risks" as any other class, but too much care cannot be given to the avoidance of unnecessary inhalation of the fumes arising from poisonous chemicals. Ventilation and a frequent airing of the dark-room will secure you from evil results in this direction. (See page 92.)

194. There are other defects, many of them, which annoy, but they can be largely avoided by regarding the following rules: Have your glass very clean; keep your bath well filtered and slightly acid; let your collodion be a good orange-yellow color; have your developer fresh and clean; see that there are no splits or cracks in your dark-room, by which white light is admitted; see that your cameras and plate-holders are in good condition and perfectly light-tight; never allow reflected light to enter your camera, but so screen your light that the direct rays will fall on the sitter, and leave your camera in the shade; never take out or develop your plate by too strong a light; if you use yellow glass to light your dark-room, coat a plate, and expose it for three or four minutes near the glass, and then develop it; if it fogs, put a yellow cambric curtain over your glass; keep your hands and everything about you *perfectly clean.*

abundance, he will breathe them in such attenuation that they will do no harm.—DR. NORMAN BRIDGE.

194. "Closet speculations," as I will term them, are, perhaps, the most dangerous things which can be thrust forth on far-off and credulous readers. Of these we have ever and anon a surfeit. They are, of all things, most difficult to detect. No doubt many are given in good faith, but there is a good deal of "hap-hazard" to be gone through before we arrive at the realization of our hopes. One will tell you to a centigramme how much silver he dissolved in an equally certain quantity of alcohol; that it was heated, etc.; but he cannot for the life of him tell you, short of an almost unheard-of experiment (for an ordinary photographer), whether every atom of that silver nitrate was "got in." By the addition of certain bromides, chlorides, and iodides (one or more combined), he has obtained *about* that which was necessary to the successful working of his process. Luckily for photographers, the "chemistry of photography" is good-natured, and seems to admit of a "rule of thumb," but in order to appreciate this, we must always be on the lookout.—A. M. DE SILVA.

LITTLE THINGS WORTH LOOKING AFTER.—Keep the inside of your camera-box free from dust: I have heard bath solutions condemned when the fault was dust from the camera-box. Every time you shut your ground-glass, or put in the shield, draw the slide, or remove the shield, you start a current of air that will put any quantity of dust in motion if it is in the box. Keep your shield or dark-slide well greased. Be sure you wipe off all, only what goes well into the pores of the wood. It will not injure the working of any of your chemicals, will keep the shield in the best of order, and will make one shield last longer than two would without it. Lard or mutton tallow will do.—FRANK ROWELL.

LESSON I.

RETOUCHING THE NEGATIVE.

195. The practice of retouching the negative is too general now to use any argument against it. Its legitimate object is to remove natural blemishes in the skin, and to help to preserve the half-tones or middle-tints in the negative. But it is used to such excess in many instances as to make the likeness hard to discern, and to utterly destroy the delicate work of the manipulator. There is a *mechanical* sort of retouching, and there is an *artistic* one, too. Strive always after the latter.

196. Retouching the negative consists in working upon the collodion

195. Retouching.—I think the practice of retouching the negative a sad thing for photography. It is impossible, for even very capable artists, to rival or improve the delicate, almost mysterious, gradations of the photograph. Magnify the photographic rendering of, say, the human eye, with a strong lens, and it is found to be almost startling in its marvellous truth. Magnify the retouched image, and it will look like coarse deformity. It ceases to be true. I have sometimes seen a touched photograph which looked very nice, but it possessed no interest for me; I knew it could not be trusted. I have been charged with sophisticating photographs because I combined and masked and sunned prints. But there is a great distinction between suppressing and adding; I never added. I stopped out portions of the negative which I did not require to form my picture; I sunned down that which was obtrusive, and where one negative would not serve, I used two or more, joining them with as much truth as I could. But I never attempted to improve negatives. I never believed that I could draw better or more truly than nature. I consider a touched photograph spoiled for every purpose.—O. G. Rejlander.

There are many negatives taken that require very little, if any, retouching. The retouching-frame, however, is the best place to determine that, and consequently I take my negatives there for examination. There are three points that can be made here upon this subject: 1. Are there skin blotches that would make the print unpleasant, if left as they appear upon the negative? If there are, remove or soften them. 2. Has some unfortunate circumstance produced more or less holes in it? If so, stop them up. 3. Were you unfortunate enough to get too strong a contrast between the lights and shades? If so, blend them. These are the three principal points to be considered.—I. B. Webster.

196. The following formula I find of the best proportions:

Best Orange Shellac in flakes, ...	2 ounces.
Carbonate of Ammonia, pure crystals, ...	4 "
Soft Water, clean, ...	24 "

Quantity when finished to be sixteen ounces.

film with pencil and color, after first securing a "tooth" or a "biting" surface for them by the application of a varnish, or by rubbing, in order to modify the image to suit the ideas of the artist and his patron as to beauty of result. It is a safe process, if the one practising it knows what it is desirable to produce. A rough proof from the untouched negative should be at hand as a guide, and the greatest care taken not to alter the likeness.

197. Those who have had no practice in this delicate department of our art, should experiment upon useless negatives until the hand becomes accustomed to giving a refined touch and the taste is educated to

Heat the water in a tin vessel, of a capacity of at least one gallon, with a convenient handle attached, to facilitate quickly removing from the fire when inclined to froth over. When near boiling, add the ammonia crystals slowly, as a fierce ebullition will take place; when nearly dissolved, add the shellac and stir rapidly to keep the shellac from running together; continue the boiling until all is dissolved, which will require about twenty minutes. Don't get impatient and throw in more ammonia, because it is not necessary, unless the shellac is allowed to run together, and the ammonia should be evaporated by long boiling; stir rapidly and boil quickly. Continue the boiling until the hot solution can be poured into a tin pint measure. The time usually required for the whole operation is half an hour. Let the solution remain in the measure until cold, say over night, when there will be a scum on top, which remove; then filter, and it will be of the right consistency for use. Procure two wide-mouth pouring-bottles, but use no stoppers or coverings, as in removing them they will dislodge dry scales from the mouth of the bottle, which will flow upon the negative. Label them No. 1 and No. 2; the use of No. 1, first, is to avoid the dilution of No. 2, or final flow, which should be retained at a proper consistency, for retouching upon it will need an occasional filtering, and even with two bottles will in time become too much diluted, when it will be necessary to boil a little. If in boiling it becomes of a milky color, it is a sign of precipitation of the shellac. Remedy, throw in a small lump of ammonia, when it will soon assume a dark cherry color. Always flow the negative while wet.—C. M. French.

Take one ounce of turpentine and add twenty drops of balsam of fir, and you will have a retouching varnish putting benzine clean out of sight. Rub on the part you wish to retouch with a piece of cotton, then with another piece of cotton rub off the surplus moisture, allow a moment to dry, and rub again, and a nice retouching surface will be the result.—R. W. Dawson.

197. Let us take a negative as an example. It is, in consequence of under-exposure, out of harmony; the scale of tones is broken. Now, what is wanted is to supply, with color skilfully applied, the tones missing. In the first place, then, commencing with the lights, I find there are no high-lights; the lights all over the face have spread too much, and a flat tint half across the face is all there is, where there should be at least three tints or tones. The first thing to be done is to put on the highest lights. These are upon the forehead, the nose, and chin; these must be made two tints deeper, that is, more opaque than the surrounding parts. Next, work near these lights, gradually up to them, but still leaving them one tint higher than the color you are putting on, and, working from them, gradually blend

a degree that will guard against excess. First remove the worst blemishes, and then very carefully, indeed, attack the minor ones, referring frequently to your proof. Both stippling and hatching may be used, according to your own feeling in the matter.

198. Never allow yourself to grow into the habit of careless manipulation with the expectancy of "making it up" in retouching. Make the very best negative you can *first*, and then *improve* its delicacy by retouch-

the color into the tint of the negative. By this means there have been two tones added to the scale. Now, taking the shadows, I find they are too much spread, and come too abruptly up to the lights; in fact, that numbers four, five, and six of the scale are missing. Now, working from the lights, and using less color as I get nearer the deepest shadow, I supply the tones missing. I have now a negative that will be perfect both in harmony and gradation.

Another negative has been over-exposed, and the print wants depth and vigor. As we cannot take out shadows, we must add color, to build up the lights to sufficient strength to allow the shadows to print deep enough. This is done in the same way as in the former case, putting on the highest lights very strong and working from them.

And now a word of caution: Do not use much gum in the color; if possible do without it altogether, for if gum is used, and the printer is not very careful, the silver on the face of the paper will come off upon the retouching, and, darkening with every exposure, will eventually stop the light out altogether, and white spots upon the face are the consequence. This can be avoided by warming the negative and paper before putting them together.—George Croughton.

If there is a crooked nose, try and straighten it by making the high-light appear as it would if the nose were straight; cut the corners of the mouth; lighten the shadow under the eyes; fill up the sunken cheeks; modify any unfortunate wrinkles; sharpen the eyes by intensifying the white and drawing the line of the upper and lower lids. Now proceed to smooth the complexion, but be careful not to smooth all the roundness out of the picture; see that you do not reduce the high-lights too much by bringing up the shadows and half-tones. But if there appears to be a flattening of the face, judiciously intensify the high-lights; avoid, of course, too great a distribution of the high-lights, which will give the picture a glistening or choppy effect. One of the greatest things in retouching, and one that requires considerable practice to attain, is an artistic touch. By this I mean so manipulating the pencil as to produce that transparent and peachy texture which may be observed in a fine water-color or india-ink picture. This effect is produced by a series of hatches done in a perfectly true and free manner, each stroke of the pencil being put exactly where it belongs, and not overlapping its neighbor, and producing that spotty and unquiet effect so objectionable to the educated eye. Do not take the pencil, and start in with the purpose of laboriously stippling the whole negative, regardless of what comes in the way, whether it be light or shadow, so that the picture comes out as if it had been sand-papered. Such a manner of working produces nothing but a tame and insipid effect, and has been the cause of most of the objections to retouching.—N. H. Busey.

198. Retouching *cannot* produce a perfect picture from a really bad negative; and yet, nevertheless, there are photographers who, before retouching was generally used, worked

ing. For such purposes only should this power be used. Retouching is not "making smooth." You want a delicate play of half-tone, light, and shade preserved over the face, and no retouching should ever be allowed to cover it up.

199. The appliances needed are a retouching-frame, pencils, brushes, some crimson-lake and Prussian blue color, a cake of Gihon's "Opaque," a brush for each of these, and a magnifying-glass. With their judicious use by careful hands, and with feeling for the work, negatives can generally be helped in their printing qualities to a pleasing degree. They may also be spoiled to a hopeless degree, if the appliances are *not* carefully used.

with the greatest ambition to produce the very best work, have now become careless, "as all that can be helped *by retouching.*" To such, instead of improvement, it is a drawback, and they must reform, or eventually be superseded by the more zealous and careful ones of the craft. A competent retoucher should be acquainted with the general anatomical features of the face, a slight knowledge of drawing at least, and a thorough understanding of the effect of light and shade, that when working, none of those soft shades and little wrinkles which characterize the face are erased, thereby destroying the likeness, and causing the picture to appear *flat*. In working up a negative, never *overdo* it. This is the greatest mistake, and one generally practised; the face in such work appearing like the smooth, stretched head of a drum, or in disagreeable splotches, termed *chalky*. Another method is to produce what is called eggshell surface, the whole appearing as speckled as the surface of a guinea-egg reduced. This is the most objectionable, as it entirely misrepresents the surface of the skin, and yet some *artists* take special pains to produce such pictures, which, to any one of artistic taste, must seem ridiculous. The right manner is to remove glaring imperfections, or hard shadows, and to regulate disagreeable features in such a manner that the marks of the pencil do not show in strokes or dots on the finished print.—ROBERT MORGENEIER.

199. I have at hand a cake of water-color, called neutral tint. Upon a piece of china (porcelain) plate drop about two drops of clean water. Now take the cake between the thumb and finger and rub one end of said cake a very short time in those drops of water, and a sufficient quantity of the color will be deposited upon the white plate to last a long time. Do not attempt to use it until the water has dried out of it, which consumes very little time. Now provide yourself with a two-ounce wide-mouth bottle; half fill it with water, and set it upon the table near the white plate with color on it. You will also need two camel's-hair pencils, with long handles, and a cake of Gihon's "Opaque." Let's see now; is there anything else needed? Yes, you need a painter's rest-stick. To do this well, your hand must be perfectly steady, and at the same time flexible. You must have a stick of some sort, and this is the best.—I. B. WEBSTER.

With the articles that I have mentioned, first-class touching can be done by care and patient practice. One great advantage of the water-color over the pencil is the facility with which the work can be undone if not satisfactory in the first, second, or even the tenth effort. In some cases the pencil is good, especially if there is very little to be done. Even when using the pencil, do not use any modern means recommended to roughen up the surface of it

200. As the retoucher progresses, *if he thinks*, he will discover many methods of doing this delicate work which will serve him to good purpose. Inspiration comes in here, too, and the "learning how" will never end, because no two negatives require the same treatment exactly. *Study* your negative well before you begin. Give it credit for all the good there is in it, and then be careful you don't rob it in the least.

to what is termed tooth. All this can be effectually overcome by first whittling the pencil down to a long slender point, and finishing by means of sand-paper. Whenever the pencil fails to deposit on the negative as required, pass it over the sand-paper a time or two, and it goes off all right again. Rather a hard pencil does better in my hands than a soft one. This, however, depends somewhat upon use. The practice, however, of disturbing the varnish by the use of pumice-stone, fish-bone, emery, etc., to secure tooth, is too dangerous to be successful. I would therefore advise you not to practise it. When the skin blotches are too deep to remove with the pencil, then the neutral tint and brush come in first-rate.—I. B. Webster.

In my practice I have found the patent pencil with movable leads, made by Faber, the best for retouching, as the lead is of very fine quality and perfectly free from grit; they are also much more convenient than the ordinary lead-pencil, as they do not require to be sharpened. I have tried metallic and most every other kind of pencil, but find these the best. A pretty hard lead is best for fine work on small heads, but for a large head, where the strokes are to be bold, a softer lead is required. As a general thing, it is not necessary to roughen the surface of a negative, as the varnish will have sufficient tooth to take the pencil; but when the surface is too smooth, or it is necessary to put a great deal of heavy retouching upon a negative, pulverized pumice will be found to be very useful; just dip the finger into the pumice, knock the loose powder back into the box, and gently rub the finger over the part of the negative required to be roughened; this will be all that is necessary in most cases. Such things as grit-varnish, etc., are not only of no service, but decidedly detrimental, making too rough a surface entirely. The retouching-frames sold by the stock-dealers are very useful, and are all that is required; but I prefer to substitute for the mirror a piece of white cardboard, and to remove the ground-glass from the frame, which gives a soft, agreeable light that does not in the least dazzle the eyes. If you have a ground-glass window to work by, the mirror will do. It is much better to work in a darkened room where there is no other light than that which comes through the negative from the reflector. As far as any definite instructions can be given, the rest depends upon skill and artistic taste.—N. H. Busey.

200. It was also in Scotland that I saw a very good dodge for saving time in retouching. On the film side of the negative was strained a piece of ordinary tracing-paper; the paper was slightly dampened, and the edges being gummed, it was laid on the face of the negative and let dry; when dry it was strained quite tight, and so interposed a thickness of tracing-paper between the sensitive paper and the negative, which considerably softened freckles and other accidental markings, and gave a good surface for working in the high-lights, etc. I have tried this dodge for enlarged negatives, and can highly recommend it.—George Croughton.

A friend communicated to me a simple and very good way of sharpening the lead-pencil

201. The photographer who has not enough retouching of negatives to do to employ a retoucher steadily, will find a retouching-machine to help him over the most time-taking portions of the work, the fine finishing only, requiring the labor of his hands. There are various kinds of these advertised by the dealers. They are useful and helpful.

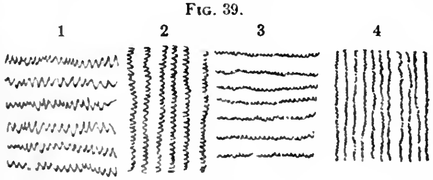
202. Books and chapters have been written upon this subject, and the one who desires to become an accomplished retoucher, or doctor of neg-

used in retouching; and I find that a fine needle-point can be made by it in a moment. Take a small piece of ground-glass and moisten a place sufficiently large, and grind the lead on it by rubbing lightly endwise (not sidewise, as that would be likely to break it), while turning the pencil so as to grind the sides equally.—FRANK A. MORRELL.

Here is the method I have adopted: Take a two-ounce glass measure, fill it with old bath solution (the strength is a matter of no moment); put in next a little pyrogallic acid—the exact amount, so that you put in enough, does not matter; the result is the immediate precipitation of silver. In a few minutes stir the whole well up, and throw it upon a filter; when the liquor has run through, fill up the filter again with water; repeat this two or three times, then set the filter aside. In a day or so, when dry, carefully remove the powder from the filter by some little scraping instrument. Put it away for future use. A small portion of this is prepared for use at a time by being ground on the palette with a little gum-water; the less the better. I work the pigment with a knife, giving a gentle circular motion, and keeping it up *till the whole dries;* the gradual thickening of the gum solution as the water evaporates seems to assist in breaking up the particles to an extreme state of fineness. This pigment can be used with water in the usual way; but I think care should be taken *not* to suck the brush, as a daily dose (people who retouch negatives at all generally do so every day, I suppose) of silver in a state of fine powder might lead to serious consequences.—STELLAR POLARIS.

201. Of the varied motions of a retouching-machine an actual drawing by the machines has been made. The annexed cut shows a very much enlarged copy of such a drawing. 1 is the "horizontal;" 2, the "perpendicular;" 3, the "diagno-horizontal;" and 4, the "diagno-perpendicular" motion, all at the highest speed, which, with the fact that these strokes are greatly magnified, accounts for the coarseness of the drawing. If the drawing represented the actual size of the strokes secured by the machine, they would be so fine the eye could not see the difference. In number one the greatest variations are shown purposely, because it must be remembered that, although the negative is moved by the machine to meet the pencil-point whenever it is applied by the hand, the hand controls the size and form of the touch.

FIG. 39.



202. On what principle is the necessity of retouching based? Notwithstanding skilful lighting, posing, and chemical manipulations, without exception the result obtained is always such that we are forced to reduce the too hard, troublesome contrasts formed by the impurity of the skin, such as freckles, scars, and other unpleasant features, which, by an

atives, will do well to gather all the hints he can. In the hands of a skilled artist, the needle-point, the brush, the gas-flame, and smoke will all be found useful appliances. In all cases, however, be merciful in your handling of a negative that is full of good printing qualities, before you proceed to—make it worse.

ordinary glance at the subject, are scarcely perceptible or wholly unnoticed. Blemishes, also, may occur in other parts of the negative which call retouching into requisition.—J. W. Morgeneier.

Retouching is misunderstood entirely. A negative being made, when the proof is produced it shows wrinkles, it shows spots, it shows lights too strong, or shades too deep. Well, we are going to retouch the negative properly. Now, here is a little line or mark that shows you the place of a bone; these little lines, if the person does not understand anything about bones, he will destroy, and the bone is gone. Here is a little mark, a little light which forms a dimple in the cheeks or in the hand, he will destroy that. Suppose it is a little strong and ought to be subdued, he destroys it entirely, and that little dimple is gone, which is one of the beauties of the face. Well, the same of the nose. I have photographs brought to me of which the nose is entirely destroyed. There is no bridge to it; there is no bone in it; it is entirely destroyed; it is a person without a bridge to his nose, an empty line without any significance.—D. C. Fabronius.

In conclusion, I would remark that none but those who have received and benefited by an artistic education, improved by constant practice, can hope to emulate the masterly examples to be found in the works of Reutlinger, etc.; such perfection can only be achieved by the experienced miniature painter, who, more than any other, should possess a keen appreciation of the value of every touch. There is still this to be borne in mind, that however unskilled a person may be in the use of either brush or pencil, if he but bring to his task an earnest and careful desire, he cannot fail to be both surprised and gratified with the amount of improvement he will be enabled to effect. Let it always be remembered, however, that the object of touching should be to remove such defects as are incident to the limited capacity of photography in rendering color, or such as are merely temporary blemishes in the sitter; and in no case to smooth away the truth of nature.—William Mayland.

Two common errors with beginners must be particularly guarded against, that of marking the eyelashes too strongly and that of obliterating them completely, making the eye look as if it had been singed. The upper edge of the lash must be softened into the lid, and the lower edge must melt imperceptibly into the shadows which it casts upon the orb beneath it. Under the outward extremity of the lash the thickness of the lid is perceptible; this must be represented as it is seen, that is, distinct from the lash and tender in tone. The form assumed by the pupil of the eye is, of course, governed by the relative position of the head—round in full-face portraits and oval in profile, intermediate forms with half profile, three-quarter face, etc. These positions in turn control the lighting of the eye.—J. P. Ourdan.

LESSON J.

THE GLASS STUDIO.

203. In order to secure the best effects in portraiture, it is necessary to have a covered enclosure free from the action of the elements, and where the light may be controlled to suit the purpose. Such an enclosure is called a "glass studio" or "skylight." The former, because it is necessary that it should be of glass in order to admit the light, and as the work-room where the painter produces his effects is called a studio, so is this, the work-room of the photographer, called the studio. The latter name is given because it must, in order to be properly lighted, be erected so near the sky that no surrounding objects can interfere with the supply of light from the right direction. In constructing photographic studios, more gross and expensive blunders have been made, probably, than in any other photographic direction. Some of the wildest theories have been followed by our best photographers in all countries, regardless of expense, in this line, and there are countless wrecks lying about as useless

203. Now do not be deluded with the idea that, whenever you see a good photographic effect, it is all owing to the *light*. It is not so. What I mean is, that a picture may be good, and yet be made in a very badly constructed light, and that the construction of the light is not the only thing to consider when you desire to make a good picture. I have seen men have splendidly constructed studios, without one idea as to the best way of working them. I have seen men working most beautiful results in most inconvenient and cramped up places. Thus you will perceive that the "light" is only *one* means of assistance in securing the best results. So, when you examine good work again, you must not only say, "His *light* is better than mine," but he has more *feeling*, more *brains* than I, together with better manipulative skill, and I must *think* how I may reach up to him.—Old Argentum.

I will say here in the beginning that a skilful artist, who knows how to use his eyes and how to judge of the distribution of light on his model, will know how to turn out a good picture even if the atelier should be faulty in its construction. The cook of our old Fritz, the hero king of the last century—and not to be confounded with the present "Our Fritz," who is his great-grandchild—made a splendid fricassee from an old kid glove, but this does not prove, by any means, that an old kid glove is the best material for making a good fricassee; but it proves the excellence of the cook. In Germany we have generally longer glass-houses than in America, and I give the preference to such, *for we can shorten them at any time by curtains*, but it is very difficult to lengthen a glass-house which is too short.—Dr. H. Vogel.

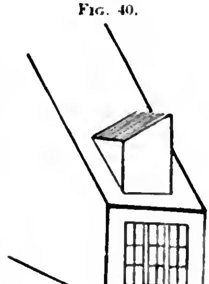
as a defunct oil-well. There should be no difficulty in the matter at all, however, though indeed there are fewer mistakes made now than there used to be. This is accounted for by the fact that the principles governing studio construction are better understood of late years than formerly.

204. In choosing a locality for a studio, the first consideration is the source of the light supply. This should, if possible, come mainly from the north. A clear top-light is needed at an angle of about forty-five degrees, and a side-light, vertical, or nearly so, running from the lowest point of the top-light to within say two feet of the floor. This side-light is best also towards the north, but answers well a good part of the day if it be on the east or west side of the building, or both. All these should be clear from shadows or reflections thrown by other buildings, for the obvious reason that any such interference would cause annoyance in the management of the light.

205. The size, form, and direction are largely governed by the site of the studio, and as photographers are usually dependent upon the alterations made in buildings for them, they must make the best of their resources. After all, it is vastly more in the management of the studio you have to operate in than in its construction. It has been impossible

204. I believe that every photographer will admit that a northern exposure, free and unobstructed, is the most desirable, because the light is more uniform, consequently it is more easily managed. Still, an east, west, or south light sometimes has a decided advantage. An east light for *early*, a west light for *late*, and a south light for *dark* weather. My own experience proves that photographers generally have to take the best they can get, and make the most of it. But there are others who *might* have something better, if they only know what they really ought to have. I have seen some outrageously defective lights, when it was simply the fault of the *liners* (see Fig. 40). Here was originally a passable side-light, western exposure, with an 8 x 8 feet skylight, flat on the roof. Now this was not so dreadful bad, but the *artist* concluded that he must "go for a northern exposure," with the result as you see. Now, he might about as well have set his "patients" in an old-fashioned chimney-corner, depending upon what light came down the chimney. Of course, the side-light took off some of the deep shadow under the eyebrow, nose, and chin, and the reflectors "countered" on the other side; still, so many cross-rays put goggles on all except "pap" eyes, and the best results obtainable were unartistic, because there was no harmony of light and shadow.—E. Z. WEBSTER.

FIG. 40.



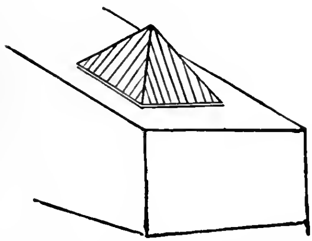
205. Here is the most common form of skylight (in the Eastern States), but it is by far the most expensive, costing twice or three times as much, and not one whit better than a plain flat sash, laid out at an angle sufficient to insure the rapid passing off of the rain. Three

to secure good effects of light and shade in some of the most expensively constructed studios, while they have been "managed" in some which seem to be the most simple and hopeless in every way.

206. The glazing of the glass portions is of considerable importance. The brand of glass known as the "best double-thick American" is suitable, though some give preference to heavy ribbed or corrugated "skylight" glass. The glass being chosen, and leakage provided against, the next thing to give attention to, is the management of the light which enters.

advantages have been claimed for this plan. 1st. Greater strength. 2d. Less leakage. 3d. *More light.* The first claim may be tenable, although the extra weight of glass vitiates the claim. The second claim holds good to a certain extent, because the steepness of the pitch overcomes some of the back-flow of the water.—E. Z. WEBSTER.

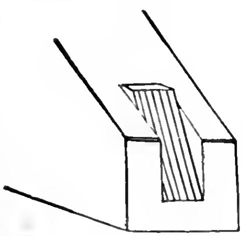
FIG. 41.



In the New England States, what is called a "cone" light is used considerably. A square hole is cut in the roof, and an elevated square cone fitted into it, glazed at the top and sides, varying in height, and the roof slanting both ways. By means of such a construction the light floods into the room in a diffused state, and the operator must work all around the room underneath it, shifting his backgrounds and accessories several times during the day, in order to escape the direct rays of the sun. There is such a thing as getting used to such a light, but I could not be persuaded to work in one unless I *had* to do it.—OLD ARGENTUM.

This is a drawing of a much better light; and, in fact, for some styles of work it is good enough. Still, exactly the same results and effects would have been produced if the light had been laid flat upon the roof and down the side of the building, thereby saving the disfigurement of the house, and also of the room.—E. Z. WEBSTER.

FIG. 42.



206. In procuring glass for skylights, the photographer who would provide against hailstones and accidents should purchase glass of double thickness, or about one-eighth of an inch thick; although the single, of about one-twelfth, will stand all ordinary usage very well. The second or third quality will answer as well as the first, as the slight imperfections which they contain will not interfere with the passage of the rays of light. In very bright days, I notice that our artists have sometimes an excess of light, which they shut off by means of curtains or screens. But in a very dark day, when they need all the light they can obtain, it is highly necessary that the glass should not be of a dark color. When we speak of the color of colorless glass, we mean that which is perceived in looking at a piece through its edge. The color should be of a light-green or bluish-green, and it should be of a quality which shall not be deteriorated in the lapse of years by the moisture of the atmosphere, which sometimes produces rust or stain, and sometimes a disintegration of the surface, which gives all the appearance of ground-glass. This defect is

Considerable has already been said as to this in Lesson A. First, a likeness is to be secured; next, a round, natural effect, by means of a gradation of light and shade. The eyes must not be sunken; the nose and chin must not cast shadows; too glaring a mass of light must not fall upon any one part, and the lights must not cross, and so on.

occasioned by the use of an excess of alkali in the composition of the glass, and a hurried and insufficient melting of the materials. Another defect, occasioned by impurity of materials or an excess of manganese in the composition of the glass, is the liability to change by sunlight exposure to a yellowish or purplish color, thus diminishing its power to transmit the chemical rays. We are most happy to record that so much has been written concerning these two great defects in glass-making, that they have been almost entirely remedied by glass-makers at home and abroad. I have no doubt that a great source of trouble with some skylights has been, that through a want of cleanliness, the coating of dirt and moisture on the glass has presented as effectual a barrier to the sun's rays as the stain occasioned by rust or the change of color by sunlight. As blue-glass and ground-glass cut off a much larger proportion of the chemical rays than colorless glass, it is not advisable to use them, unless the photographer has so light an apartment that is necessary to exclude some of these rays, or to soften and diffuse the light because of its discomfort to the eyes of the sitters. But it would be much better to accomplish these objects by means of curtains in bright weather, rather than lose the advantage of colorless glass on a very dark day.—THOMAS GAFFIELD.

The slope of the glass roof should be so arranged that at the part where the sitter is placed the light may be incident upon the subject with the least disturbance of its components; an angle of forty-five degrees, if the angular form of roof is used, will be the best, but if the extra expense is not an object, much better results will be obtained from the adoption of the half-cylindrical form, as the writer's experience of the qualities possessed by two glass studios, in identical aspect and in juxtaposition, but of the two forms in question, leads him to give greatly the preference to the circular, as possessing more evenness and greater rapidity under equal conditions of light. It may be accounted for in this manner—owing to the continual variation in the position of the sun, it is not possible to adjust the angle of the straight-sided glass roof in such a manner that the light may pass at right angles, and with the least disturbance or loss of a portion of its power; by the obliquity of its impingement on the glass it will, except at one particular interval, be incident at an oblique angle to the glazed surface, and

FIG. 43.

207. Screens and reflectors are made use of, of many forms, to control and drive the light as and where wanted. Top and side curtains also come largely into service for the same purpose. At one time it was very fashionable to blue-frost the inside surface of the glass, in order to soften and modify the light. Some used ground-glass, others paint, to soften the effect of the light, but always at the expense of rapidity. Screens and curtains are the best, because the most adjustable, and give one the power and control over the light to change it as the days change, which any permanent coating upon the glass could not allow.

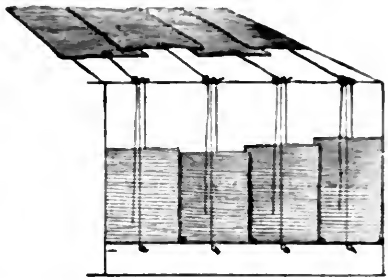
thus suffer a derangement or loss of some portion of its actinism, which is probably the reason that in practice the quality of light is found better which has passed through a *circular* form of glazed surface, which always presents the same conditions to the incidence of the luminous principle, whatever may be the angle at which it impinges upon it.—LAKE PRICE.

207. How can we obtain perfect control over the effect of light on our model, without materially diminishing the photographic power of that light? That is the problem to be solved, and we may as well say at once we have not wholly solved it, but we believe we have found a valuable clue to its solution, and it has the advantage of having been practically tested in our own studio, instead of being a mere theoretical suggestion. We have a large amount of skylight, with very little side-light; by which we mean, that our principal light is derived from the roof, with only two small windows at the side. This roof-light is a ridge roof, thus ʌ, facing north and south, and contains two lights twelve by fifteen feet each. Thus we have a large source of light to begin with, and we have tried to manage it by various systems of blinds. None, however, satisfied us, for when we had shut out the light by blinds until we obtained the desired effect, the exposure was considerably lengthened, and this we hold to be, on many grounds, objectionable. Here was the difficulty, and every photographer who aspires to the production of a picture must have felt it. We have largely overcome it by abolishing the blinds and substituting a flat roof at the base of the angle formed by the roof-light, thus, △. This flat roof consists of a light wooden framework, upon which are laid screens, formed by covering very light iron frames of about one square yard with oiled paper. Any one of these screens can be raised by pulling a string. And what is the effect? Above, there is all the light that the roof can admit, and this penetrates the roof formed by the paper screens we have mentioned, and gives a soft diffused light all over this part of the room. But this cannot produce the harmony you speak of, and must enormously lengthen the exposure. Stop a minute; let us raise one of the screens to an angle, and observe the effect. A strong light enters through the aperture thus formed, all the stronger by the reflection from the screen; and do you not see it falls exactly where we desire it? Any effect may be thus obtained by raising and lowering these doors in our false roof; and as the light has but a short way to travel, you obtain a far more powerful effect than by admitting the same amount of light at the glass roof above.—J. M. BURGESS.

Another system which is very practical and easily managed where there is plenty of room, is, first, one set of white curtains for the light and an inside room, mounted on casters, and covered on both sides and top with sectional curtains of white muslin; the *form* of the room to be as our glass-rooms are usually constructed. It must be high enough for a half or

208. Of the curtains, it is best to have two systems, one working from the bottom towards the top, and the other from the top towards the bottom of both top- and side-light. They should be of blue or gray stuff, thick enough to exclude light entirely, and worked upon spring rollers. The edges should lap. The screens may be of thin white muslin. Paper will answer, but it soon gets out of repair and is troublesome. They should be stretched on light frames running on wires and moved to and fro by means of cords or a rod. With enough of these, almost any possible effect can be managed by the skilful operator.

Fig. 44.



209. In constructing a glass studio, certain other items should be considered, as follows: a means of cleaning the outer surface of the glass of the accumulations of dust and dirt; a protection from hail; outward sun-shades; proper ventilation; leakage; a solid floor to prevent movement of the subject during exposure; lastly, a proper color for the walls, which should be of some cold, neutral tint. As to this last, a word more. Remember that if the walls are too light in color, the reflections which they cause will continually annoy you. A dark gray is easily kept clean, and does not disturb your management of the light used in making the portrait.

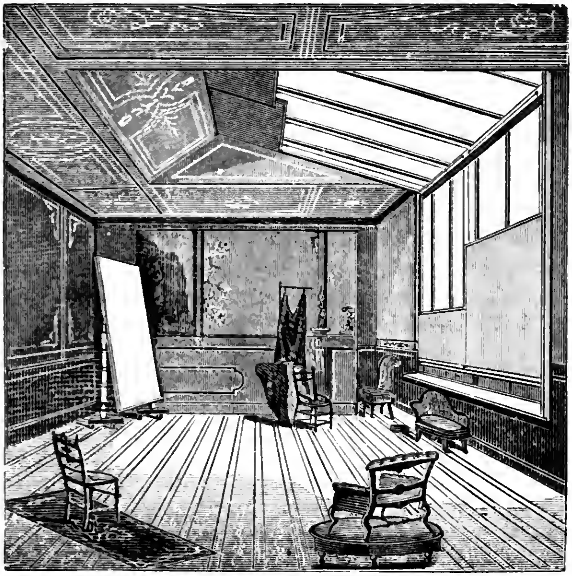
three-quarter length figure. It should be provided with a semi-opaque screen which may be adjusted over the head of the sitter, and another which may be used at the side to increase the strength of the shadow if necessary. This for a south light is the best arrangement which I have ever seen.—L. G. Bigelow.

208. There is no better color for shades than white, for you are enabled to judge correctly the strength of every light, and the depth of every shadow. For semi-opaque shades, a drab color will never confuse by false impression of the density of your shadows.—L. G. Bigelow.

209. The writer has applied with success, a simple means whereby cleanliness of the glazed roof, at the least trouble and outlay, is promoted, whilst at the same time, the intense heat to which the glass studio is exposed during the summer months is greatly mitigated by evaporation from its surface. Carry along the ridge of the top a leaden or zinc pipe perforated with holes; it can either communicate direct with a cistern—above its level—and be made to act by turning a stop-cock, or can be connected with a small forcing-pump, which is inexpensive. By allowing the water to percolate from it, at intervals during the day, the heated glazed surface is greatly cooled, whilst at the same time accumulated dust, soot, etc., are removed.—Lake Price.

210 The best form and pitch of the studio is not agreed upon universally. A great many plans have been given in the magazines. The annexed drawing is one of many which have appeared in the *Philadelphia Photographer* from time to time, and represents a good model throughout. The pitch is about forty-five degrees, and it is what is known as a "low" one. Undoubtedly a low, long room gives the operator more advantages than a high, short one. If the light is long, it can readily be shortened by means of screens, and it is often an advantage to have it long. If it is steep, it will undoubtedly diffuse the light more than a low one, and, therefore, be more difficult to manage—perhaps slower as well.

Fig 45.



210. A steep light, about fifty degrees incline, extending to within five feet of the floor, and not less than fifteen by fifteen feet square, is probably a form of light more easily worked and with better results than any other, for small groups and single figures. Such a light is always from the right direction, and even a novice in lighting would scarce find difficulty in producing very acceptable pictures. Lights are often constructed with the top-light inclining toward the position usually occupied by the camera, giving, of course, more *front*-light than in the usual plan where the incline is toward the side-light. Such form of light may be in a few exceptional cases of benefit, but in the majority of sittings a disadvantage, because the tendency to make a flat picture is sure, and in many instances to entirely destroy the delicate modeling which indicates the form of the forehead. There is so much of character in this feature, that the preservation of it is of very great importance in finishing a characteristic and artistic picture.—L. G. Bigelow.

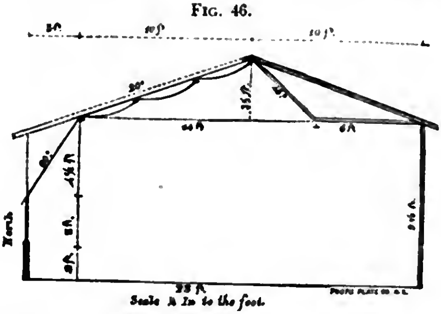
It must be strictly borne in mind that light in striking glass is diverged; it does not travel in parallel rays. You will find it out in practice; it is good in theory, but not good in practice. That is my objection to it. Those who think a steep light does not work quickly are much mistaken.—W. H. Lockwood.

A few years ago I moved into rooms having a side- and top-light, the lowest point of

211. As has already been said, the site which a photographer is compelled to choose, must, in a measure, regulate the construction of his studio. Enough has been said to supply ideas for the building of almost any form, and to suit almost any circumstances. It is a matter which should have the most careful thought, for, remember, it is your means of living, and should not be stinted in any degree. Some photographers think the reception-room should have the first consideration; but it is a blunder. The operating-room is where the money, and the reputation, and the work which brings them, are made, and it should be well built and well furnished, even if the other departments have to be robbed to support it. Give it your best consideration.

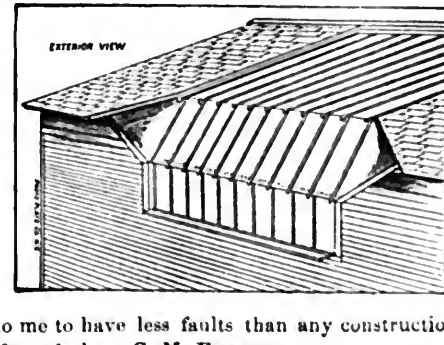
which was fourteen feet from the floor. I found it to be quite unmanageable, and went to the expense of putting in a second sash eight feet from the floor, glazed with ground-glass. This was an improvement, with the objection of too much loss of light on cloudy days. I have now taken this second sash out, and substituted a double set of curtains, blue and white, made to slide on wires stretched lengthwise of the room, with the lowest set seven feet from the floor. They are one yard wide, and can be drawn, of course, to the extreme size of light, or shut up so as to admit but a small portion of light on the sitter, the rest of the room being in quite a deep shade. I find this a great improvement, besides being easier for the sitter; the negatives are much more excellent with no more exposure.—A. Marshall.

Fig. 46.



211. I have drawn a hastily prepared sketch of a skylight that I think would be superior to anything I have seen. I think its advantages are these: First, being low, it will work soft and quick; the first slant of the glass roof being at an angle of only twenty degrees, it brings the highest point near the sitter. Second, the second slant being at an angle of sixty degrees, it shuts out the sun's rays, and gives a fine illumination upon the sitter at an angle of fifty or sixty degrees, and in the exterior drawing it will be seen that the corners of the roof being cut off or slanted back from the light, gives full scope for all the light obtainable. Of course, the light would have to be boxed in, to secure a ceiling, which I have represented at an angle of forty-five degrees. It seems to me to have less faults than any construction I have ever tried, though it may not be free from faults.—C. M. French.

Fig. 47.

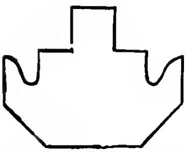


212. The greatest of all trials in skylight building is the proneness to leak. Sashes of peculiar construction, guttered sash-bars, and inside gutters have all been used, and all are good. Guard against the trouble *thoroughly in the beginning*, if you would avoid annoyance. It *can* be done —do it.

213. Finally, protection against the sun at such certain times of day as when it shines too directly upon the top-light, and from damage by hail. When a flood of direct light comes upon the top of the glass-house, as it is apt to do in the longer days, no system or amount of screening or curtaining is sufficient to prevent the annoyance which it gives. You never know when it is going to trouble you the most. It destroys all your calculations, gives trouble to your sitter as well, and is an endless aggravation. Wholesale shading only will prevent it, and for this outside screens are the best. For the prevention of damage by hail, wire cloth with large meshes may be placed over the entire glass portion, but some light must be lost. As to these difficulties, the best ideas will be found in the notes below.

212. It does not cost much more to build a skylight that never leaks than one that is leaking all the time. The form of guard should be made in this shape.

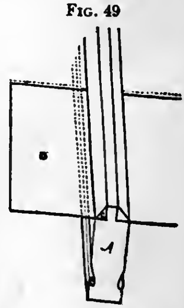
Fig. 48.



It will come down (the rain) and run to the sash and meet this gutter and run out-doors, and the room is always dry. My skylight has not leaked a drop since it was built, and I do not suppose it will in a hundred years.—Alexander Hesler.

I give you a sectional view of the sash-bar. A shows the *end* of the bar; B, the groove or gutter; C, the putty; D, the glass. This is the best plan; and, after more than twenty years of constant use, I am satisfied that it is the only successful one.—E. Z. Webster.

Fig. 49



Many other plans and devices have been tried, but all have proved unsatisfactory, or but partially successful. Some have recommended raising the lower end of the upper glass at the lap about one-eighth of an inch, to lessen the effects of capillary attraction, but a strong wind against the laps drives the rain back in torrents. (See Fig. 50.)—E. Z. Webster.

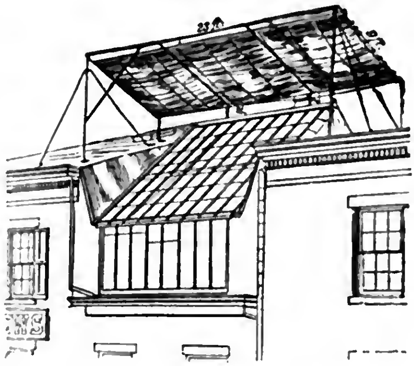
213. Another question of importance is the exclusion of sunlight from your glass-room. For a north light of the usual inclination, there is no better way than to erect a solid screen of sufficient height to accomplish the object. I have tried inside and outside blinds of canvas and solid material, but no system is so free from objection as the roof-screen or shade. Any system which keeps the sun from the glass is, of course, a very great consideration in summer, on account of the lessening of the extreme heat. The way mentioned does this, and does not exclude light.—L. G. Bigelow.

Fig. 50.

214. To enable photographers who are entire novices in this direction to construct a glass studio, an amateur photographic friend, and a skilled professional architect, Mr. G. W. Hewitt, of Philadelphia, has provided suitable working drawings and specifications, especially for this work. The terms used in his description and directions are such as should be understood by any builder, and the dimensions given are in good proportion for a rapidly working and easily managed apartment. Following these instructions, no photographer can fail to make his carpenter understand his wants, and no one can go far wrong.

I have an unobstructed north-light, 12 x 14 feet, at an angle of 40°, lowest point seven feet from the floor, with side-light 5 x 12 feet, two feet from the floor. My awning-frame is made of one and a quarter inch galvanized iron pipe, 23 feet long by 9 feet wide, with two middle bars, 9 feet long and about 7 feet 6 inches apart. The frame is supported on the peak of the skylight by studs 1 foot high, which allows the free passage of wind. From the peak of the skylight the frame rises at an angle of about 18°, the whole properly braced and fastened to the roof.

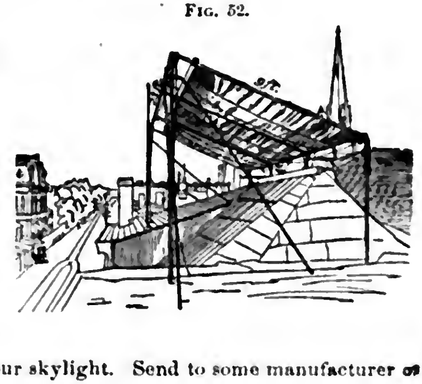
FIG. 51.



The awning—8½ x 23 feet—is made of drilling, securely tied to the bar on the peak of the skylight, and with rings on the side and middle bars, so that it will slide up and down free and clear of all obstruction. On each of the 23-feet sides are fastened two pulley-blocks, through which ropes pass, for the purpose of raising and lowering the frame by a sliding motion. Thus it will be seen that all that is required is to raise it in the morning, tie it securely, and lower it at night, or on the approach of a heavy wind or storm.

As will be seen from the above description, the awning extends east and west about five and a half feet over the light, thereby cutting off the rays in the early morning and late in the afternoon; and on the north side extending up, and by dropping a plumb-line would cover about two-thirds of the light, thus shielding the light completely from the sun.

FIG. 52.



I have used this with the most perfect success, and would not, in the future, be without it. It relieves the eye from that glare which is so objectionable to a great many, and, besides, makes the operating-room several degrees cooler.—JOHN REID.

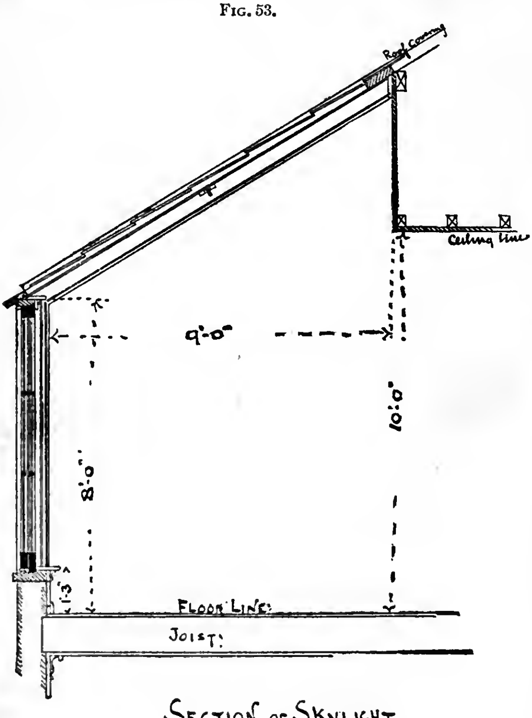
Make a good substantial frame, full size, of your skylight. Send to some manufacturer of

215. The drawings which follow were made after the glass studio, under the inspiration of which a goodly portion of this work was prepared, at 912 Chestnut Street, Philadelphia. It is modelled after the fashion most in use in this city, with the glass portions, both top- and side-exposure, erected towards the north, and its interior in appearance much like the plan shown in Fig. 45, page 160.

Before going into the details of its construction, it will, perhaps, be well to have a good impression of its construction as a whole.

216. For this purpose, please first attentively examine the sectional view shown in Fig. 53. By the numbers, it will be noticed that the interior, from the side-light to the rear line of the top-light, is nine feet; the distance from the floor line to the lower height of the top-light or extreme of the side-light is eight feet, of which one foot three inches are wall, before the lower line of the side sash begins. The height from the floor line to the ceiling line is ten feet, and to the highest point of the skylight it is about thirteen feet. This is a matter which the building in which the studio is constructed must govern somewhat. It is believed that seven feet from the lower incline of the top-sash and ten feet for its upper height would be better and work more

FIG. 53.



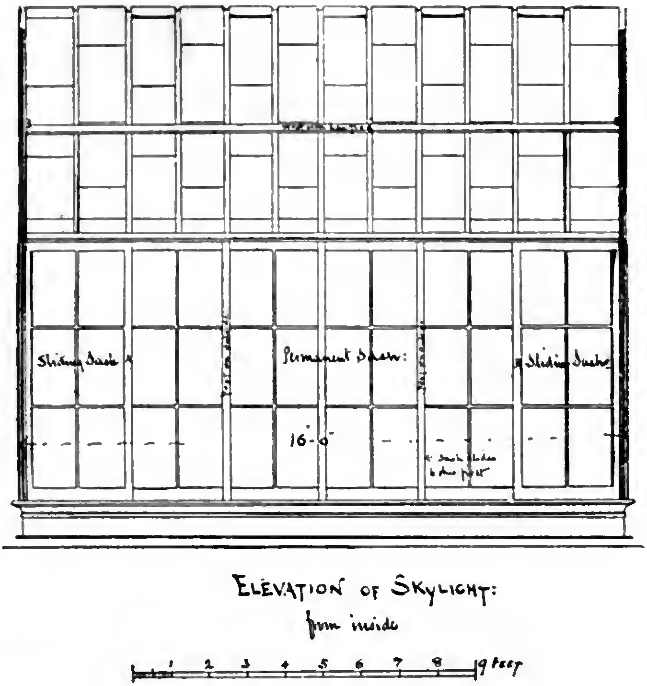
SECTION OF SKYLIGHT

dealer in wire-cloth and get enough wire-cloth, of one-half-inch mesh, to cover the frame. Stretch tight on frame, then paint white on both sides, and place over the skylight about ten inches from the glass, fasten securely, and you can depend on it your skylight is safe from anything short of a tornado or cyclone.—Z. P. M'MILLEN.

speedily. As has been observed in the previous notes, opinions differ on this point.

217. In Fig. 53*a* we are given our architect's elevation of the sky- or top- and side-lights, and by this we learn, too, that the working length of our studio is sixteen feet. At each end of the side sash sliding sections are pro-

FIG. 53*a*.

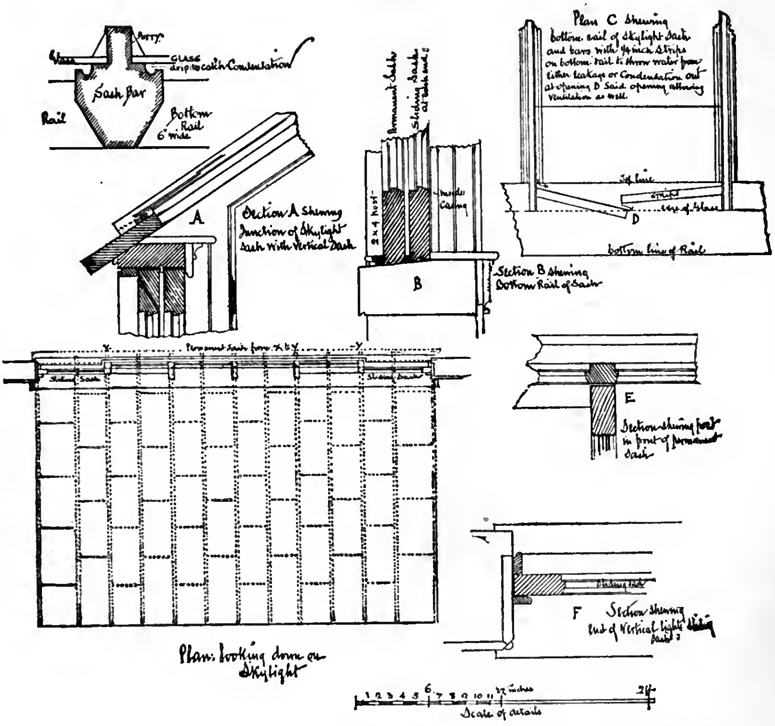


vided for purposes of ventilation, while the central section is permanent. The method of glazing is described further on in the specifications. This latter differs, however, in the matter of the top-light, which must be so constructed as to oppose the elements, keep out the dust, and provide for the condensation of moisture which is apt to occur inside. An iron bar is run across inside, underneath the sash, for sake of strength. For further details, please proceed.

218. Now please examine the various sections of Fig. 54 attentively before going into the details of the specification. They are given for the guidance of the carpenter or builder. Section A shows the junction of

the skylight sash with the vertical sash; section B shows the construction of the bottom rail of the side sash and the permanent and the sliding sash at each end, together with the outside post and the inside casing; by the plan, C, we are shown the bottom rail of the skylight sash and bars with one-quarter inch strips on the bottom rail to throw the water, which

Fig. 54.



comes either from leakage or condensation, out at the opening D, said opening allowing ventilation as well; section E shows the form of post required in front of the permanent sash, and section F shows the end of the vertical or side-sliding sash. An end view of the sash-bar construction of the top-light is also given, showing the relative places of the glass, the putty, and the drip-line for catching condensation or leakage. To these is added a plan of the top sash, looking down from the rear towards the junction with the side sash.

219. Before proceeding with the specifications for the construction of a

glass studio after the model given, it must be understood that the dimensions given are not arbitrary. They are mere suggestions given with the hope that more intelligence will be devoted to this important branch of preparation for the practice of our art also, both for the sake of the results and for the welfare of the pocket photographic.

220. For the further information, then, of the glass studio constructor, find now the architect's specification of workmanship and material required in the construction of a skylight in accordance with the accompanying plans: All material, unless otherwise specified, is to be of first quality white pine, worked fair and free from all defects. In general construction, the skylight is supposed to be inserted in a roof already built, and to occupy a space on the floor plan of nine feet in width by sixteen feet long, other dimensions being marked. The four central portions of the vertical sash are stationary, the sash at either end sliding back of the next adjoining as shown. In the event of the skylight being built independent of other work, the thickness of the partition beneath the sash need be only just sufficient to receive the sash and stop-bead on the inside. As drawn, it is supposed to be inserted in the upper story of a building, with a nine-inch brick wall for support under the sash. The heel-plate on which the skylight sash rests is supported at intervals by two by four posts, chamfered on the outer edge, and resting on a sill made wide enough to receive them. The sash bars of the skylight are two and a half inches deep, as shown, with a groove etc., at the sides to receive the condensation and any leakage that may occur, and to conduct it to the bottom of the sash, where it is turned to a central opening by one-quarter inch strips planted on the bottom rail of the sash. The bottom rail is one and three-eighths inches thick, and the bars are cut square on it, allowing the rabbet for glass and groove to pass above it, as shown. The vertical sash to be made of two-inch stuff, divided into lights, as shown, with numbers, and a top and bottom rail of the dimensions marked. The skylight bars are to be supported at the centre of their length by a wrought-iron purlin three-eighths by three and a half inches, with angle plates at the ends, and screwed to one and three-quarter by six-inch facia on the slope, as drawn. The sash, throughout, is to be glazed with the best quality double-thick American or ribbed glass. The vertical sash must be well bradded, glazed, and back stopped with black putty, the top sash well puttied, the glass not lapping

more than a half inch. Before glazing the skylight, a cord should be placed in the grooves, to be drawn out after puttying up, in order to keep the grooves clear. The glass must be left clean and whole on completion of the work. All wood and metal work to be painted with three coats of the best white lead and linseed-oil paint, in such plain tint as may be directed or agreed upon.

With all these details in hand, no photographer should find trouble in securing for himself the construction of a glass studio that will, with good management, enable him to produce the very best of results,—such as will make him both reputation and riches. As to the length and height of the studio, you have been given argument sufficient to guide you to a choice. It is easier to shorten a long room by screen or background than it is to lengthen a short one, and there are times when, in case of a group being demanded, for example, a long room will be found extremely convenient. As to height, a high light must naturally diffuse the light more than a low one, and therefore be more difficult to manage. It must, for the same reason, work more slowly. These difficulties may be overcome, but why have them at all? In a low light, less time is required to cajole and drive the falling rays where you want them, and they act more rapidly, too.

As to glass, a good deal of breakage and trouble from leakage can be avoided by using the best white, thick, ribbed glass, since it comes in large plates. Its first cost is greater, but, all things considered, it is believed to be the best in the end, and the most economical.

LESSON K.

ACCESSORIES AND LIGHT.

221. TASTE must be exercised in the choice and use of backgrounds and accessories by the would-be superior portraitist. There can be no rule to guide him in their selection, except his judgment and feeling, and the requirements of his patrons. Plain and fancy backgrounds, and plain and fancy accessories are both needed. Your manufacturer and dealer will sometimes be able to guide you in their selection, and assist you. Consult the first lesson of this work, follow its injunctions and you will scarcely blunder. A plain, tidy carpet, or rug, will complete the furniture of your studio, and fully equip you for work.

222. Frequently, the background is about the last thing the photographer seems to think of; but it *should* be one of the first, for the reason

221. The power behind the throne in many of the composition pictures which have attracted the attention of the public is the background—silent, substantial, powerful, exerting a deep and ofttimes mysterious and unrecognized influence over the products of the knight of the camera. Atmosphere, delicacy, refinement, strength, vigor, elaborations, balance of light and shade are imparted by the background. It indicates the hour of the day, morning, evening, starlight, moonlight, and leads the subject by the sea-shore, up the mountain height, through the garden, or over fields of snow and ice, surrounds him with the evidences of luxury and cultivated taste, or the extreme of poverty and simple wants, helps to tell the many incidents of every-day life, records the triumphs of the stage, and is ever susceptible of new and untried forms; in fact, affords the widest range to photographic representation and to the play of the artist's imagination.—L. W. SEAVEY.

By many operators the background is considered of but little importance, but by the thinking, successful worker, a thorough knowledge of its uses is considered of as much importance as the knowledge of chiaro-oscuro or photographic chemistry. And our most *feeling* and *finest* photographers are not only well informed in the foregoing, but also possess a certain knowledge (whether they know it or not) of anatomy, physiognomy, and phrenology. And my humble advice to the hungry photographer, who seats himself down to the table of photographic literature, now so bountifully spread, is to call for a few of these last-mentioned side dishes, and do not leave them for the last courses, either.—W. H. TIPTON

222. In regard to the relief of figures, objects contrasted with a light background will appear much more detached than those placed against a dark one. Those parts which are farthest from the light will remain the darkest, and every distinction of outline will be lost

that it has very much to do with the general effect of the picture. Now what is a background for? Very evidently, in the first place, to shield improper objects from appearing in the picture. What difference does it make, if any sort of an object *does* appear in the picture? Well, the aforesaid object might not harmonize with the subject, and would not perhaps give the proper relief to the figure. Well, now, we have hit it. It is the latter reason that we wish to bear more particularly upon. The former has been borne so long, and many photographers seem so impregnated and saturated with the idea that a background has nothing to do with the figure, but is only to serve to hide the objects behind it, that it is almost impossible to filter or dissolve it out of them.

It is *relief* that we want, in both senses—relief from the old, stupid way, and relief for the figure. Sitters should not be planted up against a flat nonentity, as plaster is "thrown" upon a wall, looking as if they were going to slide downwards and forwards. The figure should *stand out in relief like a marble statue.* Much of this effect must be secured by proper lighting, but not all, for the background does its full share when it is a well chosen one.

With one plain distemper background, not very dark, you can manage to get some very nice effects; not very dark, because you can *shade* such a one, but you cannot lighten a dark one very well. You can secure gradation by using your background placed at an angle to your lens, or you can, by the careful arrangement of a curtain at one side, *shade* it gradually so as to get a similar effect.

In placing the figure, of course you know that the shadow side should be against the light part of the background, and *vice versa.* Again, that the shade should be increased or diminished according to the complexion of the subject. Work by contraries.

223. By the choice and use of the backgrounds, the real talent of the

in the general mass of shadows; and unless they have their reflexes, they will either cut hard upon the ground, or appear to become a part of it. All bodies being surrounded by light and shade, the artist may so arrange his figures that the dark side will fall upon a light ground, and the light side upon a dark ground. This arrangement serves to detach the figure, and, at the same time, contributes to harmony of effect. The reflected lights will be more or less apparent in proportion as they are seen against a darker or brighter ground, because of the force of contrast. Reflected lights may be so thrown as to modify the force of a cast shadow.—M. A. DWIGHT.

223. Fuseli says, "By the choice and scenery of backgrounds, we are frequently enabled to judge how far a painter entered into his subject; whether he understood its nature; to

photographer is often discovered. They may be too obtrusive, attracting the attention of the eye first, and distracting it from the portrait proper: they may not harmonize with the age, dress, character, and general appearance of the model, and their color and lighting may also prove ignorance on the part of the artist who introduced them into the picture. Again, if they are "fancy" backgrounds, they may be so placed in relation to the sitter as to produce some ridiculous incongruities.

224. "Fancy" backgrounds, so called, are such as are painted to represent some scene or "bit" in nature, art, history, etc., and are to be used in the more pretentious class of portraits. When they harmonize with the principal object in the picture, namely, the living model, they serve an excellent purpose, and relieve the dull monotony which would be caused by the constant use of a "plain" background. The figures upon them should usually be represented with much less distinctness than the accessories and the model, and the whole of the former should be subordinate to the latter.

what class it belonged; what impression it was capable of making; what passion it was calculated to arouse. The sedate, the solemn, the severe, the awful, the terrible, the pleasing, the solitary, the gay, are stamped by it. Sometimes it should be negative, entirely subordinate, receding or shrinking into itself. Sometimes its forms, sometimes its colors, ought to command. A subject in itself, bordering on the usual or common, may become sublime or pathetic by the background alone, and a sublime or pathetic one may become trivial and uninteresting by it." The student will readily perceive that no definite rules can be given to guide him in this department. In some subjects it is required that the principal figure should be distinctly seen, and again that it should be partially lost in the background. Success depends as much upon an eye for effect as upon artistic skill.—M. A. Dwight.

The effects produced by obtrusive backgrounds are sometimes very ludicrous. Here is the full-length "carte" of an old gentleman who is standing against a background of panel scroll-work. It happens that he is so placed with reference to this scroll, that a short, sturdy piece of it, with a heavy turn at the end, seems to issue from his coat-skirts, and he stands furnished with a stiff, curly, and powerful *tail!* A still more funny example is that of a youth who stands half turned towards a screen representing a waterfall and rocks. The fall consists of many little streams, one tiny rill of which seems to spring most conspicuously from about the centre of the youth's anatomical structure. In another picture a fountain in a garden issues, apparently, out of the head of a child, whose vacant look and helpless attitude, as she stands in that highly horticultural region, is strongly suggestive of water on the brain.—James Mudd.

224. Backgrounds, as a rule, and as they are generally painted, convey to the eye alone a very pleasing effect artistically, and we admire them for it; but when they become a part of a finished picture by combination, they lose that effect and become mere indistinct masses of light and shade, conveying no apparent meaning, at least not that which we fondly hoped to see as the result of our thought, desire, and brains; neither does it to the sitter. And the

225. "Plain" backgrounds are such as are painted in one color all over, sometimes being gradated from light to dark, horizontally or diagonally, in order to produce greater relief. More latitude is allowed in their use if one depends for this gradation upon the management of the light and shade which is caused to fall upon them. The background used for the vignette picture should be lighter in color than that used for such as are not to be vignetted, and should not be gradated. It may be circular in shape, square, or oblong.

remark the photographer constantly hears is, "Why must those ugly markings always be on such nicely (otherwise) executed photographs? That was a beautiful scene," etc. Very encouraging, truly! Well, the fact seems plain to me, and it is only on account of the artist making a background a picture in itself, instead of having any reference to the combination it takes part in. As it is always out of focus, it is always indistinct, or, as we call it, not sharp. Now, the remedy is to have a background painted as sharp and harsh as it is possible to make it, seeing always that the drawing is thoroughly correct, taking as much care with that part as though it was to be a finished drawing alone, and that every detail is thoroughly and carefully correct and clearly worked out. Mere suggestions of shape, light, and shade will not do, as is proved by our daily practice. Then, as the background is behind the sitter some ten to twenty inches, it is necessarily out of focus if the sitter is in, and the sharpest background that can be made will *not* be too distinct to make or form a harmonious whole in connection with the subject, provided it is intelligently chosen.—C. Alfred Garrett.

225. The law of massing is by no means confined to the head. The background should present a mass by itself, sustaining those of the head, and by sustaining being in unity with them, and also enforcing the other idea of breadth, continuing or commencing the discoverable direction of the light, thus carrying the sweep of light through the whole picture.

To do this the background should be graded. A few years ago we prided ourselves on being able to produce a perfectly even, flat, monotonous background. If it was darker on one side than on the other, something was amiss; and if one of the pictures, now so common, with an elegantly graded ground, had been shown us, nine out of ten photographers would have pronounced it wrong, the other would have looked doubtingly at it, hesitating to confess the pleasure he might have felt, to such extent had precedent, and pride in mechanical dexterity blinded us, so far removed were we from the sympathy with nature which comes only by long study and converse with her. The background, while in general tone considerably below the face, and in one mass, should have its variety, and the idea of contrast would lead it to place its dark side opposite the light side of the face.—W. J. Baker.

I have an idea with reference to a background which I am sure will work well. Instead of a gradated tint painted on the background, I propose to have the light itself throw a shadow over it, which will blend from dark to light much better than any artist with his brush can possibly do it. This the reader can illustrate for himself by means of a common saucer for a background and by placing in front of it a little doll's head. You will at once see what a great number of different effects you have at your command, by turning the saucer to the right or left, and by tipping it forwards and backwards; the blending is wonderfully soft, and you can have the shadow stop very suddenly also, without being

226. As a rule, backgrounds are made to stretch upon a frame with their whole surface equidistant from the camera. Another form, recommended by Mons. Adam Salomon, the renowned master photo.-artist and sculptor, of Paris, by the use of which gradation was secured, known as the "alcove" background, came into use a few years ago, but for some reason or other soon fell into disuse. Such was the fate also of Mr. Kurtz's very ingenious cone-shaped background. Both had merits, but they were cumbersome, and seemed to be ahead of the intelligence possessed by the fraternity at the time. Again, pretty much the same effects could be obtained, by gradating the plain background in various ways.

harsh. If you put the doll under a top-light, the top-light will make a shadow on the background just where it should, and if you have your light on one side, the weight of the shadow on the saucer will also come where it should; and again, if you light up with both combined, you will also find the little saucer to do its duty nicely.—WM. KURTZ.

The effect of gradation on a background in producing relief in a portrait often seems to be overlooked by photographers. No one, on looking over a collection of photographs, vignette heads, medallions, etc., can fail to notice the even and unbroken tint of the backgrounds generally.

The following plan will, in great measure, supply what is wanted without extra time or trouble: A square background (about four feet is a convenient size), on a frame with a cross-piece at the back, in the centre of which is a hole to allow the horizontal rod of the rest to pass. It will be seen that when the rest is placed against the head of the sitter the face appears in the centre of the square. There will be found no difficulty in painting this small background with a gradation from dark on one edge to light at the other. Lamp-black and whiting, with a little size, answers capitally. This can be turned round any way; light at the top, shading into dark below, or *vice versa;* or a diagonal gradation to suit circumstances or taste. It is astonishing the different effects produced by turning this background round. Sometimes the effect may be improved by shielding part of the light from the background with a blind or curtain. From the fact of this background being so close to the head of the sitter, a bold cast shadow can be obtained from the head or shoulders, which is very effective.—R. GILLO.

226. Now as to the alcove background, a few brief hints on the construction of the combination may be useful. The formation of the curved background itself is the chief consideration. Mine consists, first, of two curved pieces of wood to form the framework. These are placed one for the bottom and one for the top, at the proper distance apart, and a series of thin, narrow planks, not more than three or four inches wide, are fastened to the curved pieces of wood, the planks being fastened to each other by means of a groove and tongue. When complete, the little angles or irregularities in the curve are taken off with a plane. Probably, if well-made laths, something like those used in Venetian blinds, were employed, a more perfect and regular curve might be more easily obtained. In such case, the general framework would probably require to be a little more firm or rigid. I found it desirable to increase the rigidity—seeing that the arrangement is often wheeled rapidly about—by means of a binding of iron running round the top and bottom of the curve. The background may, of course, be painted, or sanded, or treated in any manner to suit the taste.—ADAM SALOMON.

227. As much artistic taste, a thorough knowledge of color, the effects of light and shade from various causes and sources, and the principles which govern them all, are necessary to the production of photographic backgrounds, and since America is favored with such renowned background painters, it is hardly recommended that photographers attempt

227. The backgrounds you can do by sizing your cloth with glue-size, with a little alum in it, but do not use this size to mix with your color, glue-size without alum will work the best. First, coat in your groundwork, then use your color weaker with glue-size, and all subsequent additions, until you have accomplished your purpose. It is fully as well to draw in your designs with chalk before taking in hand the color, if it is not handy for you to work without the chalk marks. The colors best to use are raw umber, ivory-black, and whiting, mixed to your fancy with glue-size.—M. H. Albee.

The influence of the background upon the quality of the portrait is enormous. The background serves to bring out the figure strong and bold, and ought, therefore, never to suppress the same. If the background bears a drawing, the details of the latter must only be faintly indicated, never strongly marked out. In order not to act too much itself, the background must be without lustre. Although good and suitable backgrounds are met with in the market at present, it may yet be of advantage to know a very simple way to make, one's self, without much trouble, an effective background for certain special purposes. As a basis, common unbleached sheeting serves usually; the same is wet and stretched smoothly upon a wooden frame, coated evenly with a thin paste, or with solution of dextrin, and left to dry. The color is prepared by mixing thoroughly ground dextrin with lamp-black and umber, and is placed dry with a linen pad upon the sheeting. After the desired effect has been obtained, the reverse part of the sheet is moistened with a sponge, which has been moistened in very weakly acidulated water, and thereby the color becomes fixed. If still greater durability should be desired, the flat-lying, quite-dry background is coated with a solution of thirty grains dammar rosin in one pound benzine; this varnish dries up dull. In place of the mixture of dextrin and umber, the following may be used to advantage. Mix in the proportion of five hundred grammes ivory-black and umber with two and a half kilogrammes boiling water, to which two hundred and fifty grammes good glue are added, which has been soaked previously twelve hours in cold water. The whole is caused to evaporate until dry, when the remaining coloring matter is ground fine. This dry color is laid on with a cotton rag upon the stretched dry sheet. It is easy to produce any desired gradations, and care is to be taken to begin painting first on that side which is to be the darker one. According to desire and necessity, white color may be admixed. Clouds are very easily painted in this way. The treatment of the sheeting before and after painting is the same as the one indicated above.

When pretty strong toning is desired, two or three mixtures of color must be made. Mix kaolin and dextrin in equal parts and knead the mixture with sufficient water to impart to it the consistency of modelling clay. This mixture divide into three equal parts. The first part knead with as much lamp-black as it will receive; the second knead with half as much lamp-black as used with the first part, and with the third part use only so much lamp-black as is necessary to impart to it a light-gray color. These mixtures must be left to dry thoroughly, when they are ground fine. They are laid on the dry sheeting and rubbed with a blacking-brush. The manner of blending the light parts into the dark parts upon

to paint their own backgrounds. It is better to pay for having them provided by experienced artists and colorists.

228. Backgrounds may be painted either in "distemper" or in oil. Of course the latter are the more costly, but they are also the more lasting, and the least subject to injury. Again, they are the more difficult to paint.

the ground depends upon the individual taste of the maker, but is again influenced by the alternative whether the picture is destined to be printed in full, or only as vignette. In most cases one side is kept darker than the other, and usually the middle appears lighter than the margin.—DR. EDWARD LIESEGANG.

228. If the ground is to be treated in oil-colors, proceed as follows: The sheeting is stretched upon a wooden frame and primed with a good paste of equal parts of starch and water. After drying, the color is laid on, the same having been prepared in the following manner: Mix ten parts white-lead, two parts siccative, and as much black-color as is necessary to produce the desired tone, with five parts oil of turpentine. This mixture is stirred well, then left quiet for some hours until the white-lead has settled upon the bottom. Now, as much of the oil of turpentine as possible is cautiously poured off, and fresh oil of turpentine is added, so that the mixture gets a good consistency; then two parts of scraped brown soap is added yet, and the mixture filtered through cotton stuff.

A large brush is used to lay this color on; the faster the whole surface is covered the better. If the stuff should extend, stretch it again tight. Sometimes it is necessary to paint it twice.

Another way consists in coating the stretched sheeting with a thin solution of glue, and after it has become dry it gets painted with a color which has been diluted with petroleum and linseed-oil, so as to be easily laid on with the brush. The linseed-oil prevents the color from drying too fast, and causes the same to flow easier.

The stretching of the painted background upon the frame is done as follows: The upper border of the background is first fastened, beginning in the middle, with short tacks at intervals of two inches, and then the frame is placed upright in order to get moistened. The back part of the ground must be very evenly moistened, *i.e.*, with cold water for glue-grounds, and with warm water for oil-grounds. With glue-grounds, be careful not to wet the front part, as the ground would be spoiled thereby. After having been moistened, the ground is placed again upon the flour, and the other three borders fastened. Backgrounds stretched in this way are absolutely free from folds. Do not omit to wet the borders thoroughly, as they are apt to tear if dry.

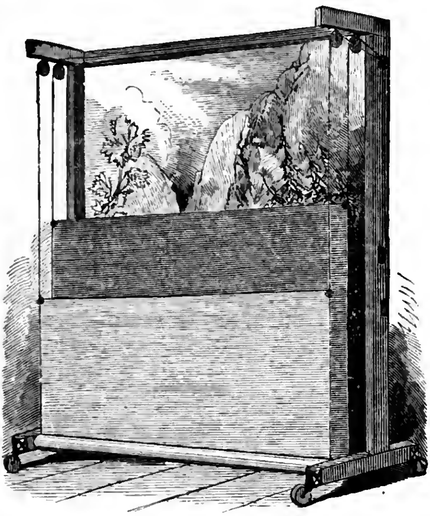
Smooth backgrounds are obtainable in the market up to a width of three and a quarter metres, and in different shades of color. For vignetted portraits, choose a lighter color than for such as are to be printed in full.

I may mention yet the backgrounds with a landscape for a motive, which are often employed. If such backgrounds are tastefully and appropriately arranged—not too much worked out in detail—they are, in most cases, of quite a good effect with portraits. It is, however, indispensably necessary to have several such backgrounds for a change, as nothing is more tasteless than a continual repetition of the same objects in all the pictures. Parlor decorations have also a very good effect, if not going too much into detail, and not "crowding out" the head and figure, which, of course, must always be the main parts in a portrait.

The wish to get the accessories and the background of the portrait as sharp as the figure is very difficult of realization, and, furthermore, shows very little artistic taste. Only in repro-

229. There are many devices which the ingenuity of the individual photographer will suggest, according to his wants, for storing the backgrounds needed when not in use. A plan recommended by the well-known amateur photographer, Mr. Charles Wager Hull, will be well understood by Fig. 55. By the use of a frame or stand and proper pulleys, the backgrounds not in use are simply let down to the floor, out of the way.

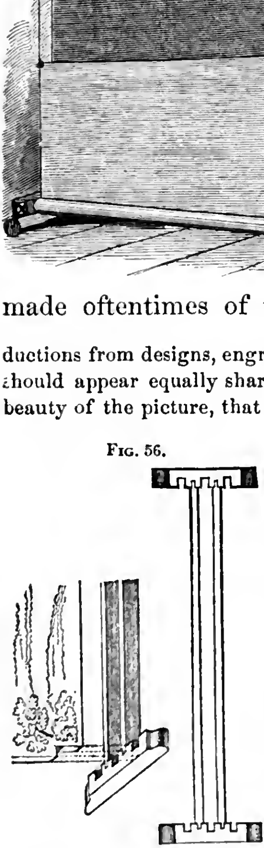
FIG. 55.



230. The introduction of accessories into the picture to help make up the proper composition is always in order, provided it is governed by the rules laid down in Lesson A. The greatest blunders are made in this direction. The difficulty is not only that art and nature must be combined, but that such incongruous choice is made oftentimes of the articles used with a given model. Profusion

ductions from designs, engravings, etc., is it of paramount importance that the whole surface should appear equally sharp. In portraits, however, it is strictly necessary, for the artistic beauty of the picture, that some objects of secondary value are indistinct and out of focus in order to bring out the main objects the clearer and more natural. In examining a photographic picture, we must not ask, "Is it everywhere sharp?" That would be a mistake. Let us see first what the picture purports to represent. If the artist designs to reproduce the mechanical copy of an object, then, of course, he is bound to render everything sharp and exact; but if he aims at obtaining an artistic effect, then the picture can only be judged according to artistic rules, and these never exact a uniform sharpness. The well-known background painter, Seavey, in New York, published a very praiseworthy essay, with illustrations, upon the use of painted backgrounds, in the *Photographic Archives* and in the *Philadelphia Photographer*.

FIG. 56.



In order to prevent the backgrounds taking up too much room, and to be able to change and shift them easily, a "shifting-wagon" may be employed, which is a strong frame of slats, contrived as in Fig. 56, and which can be easily moved upon four wheels, in every direction. In the three notches three background frames fit, which are mounted on both sides with stuff, and appropriately cut on

should never be resorted to. Harmony should be always attended to, and, above all, general effect.

231. As the photographer is required to make likenesses of all sorts of people, of as many characters and ages, he should have at hand, for ready selection, an assortment of useful accessories, with the use and appropriateness of which he should familiarize himself, so as to be able to choose quickly and with taste when the time comes for their use. With infants,

the lower corners. The frame must be pretty solid, and of a height of about fifteen centimeters. The size of the background must be regulated by the circumstance whether cabinet sizes, whole pictures, or groups, are to be taken. In the first case, a ground of one and a half to two metres is sufficient; for whole figures, two and a half to three metres, and for groups, the size of the ground will be according to the expansion desired. Dark backgrounds require much longer lighting than lighter ones; the difference is often very material in the same studio.—Dr. Edward Liesegang.

230. I, for one, think the tendency of the day is too strong towards obtaining startling effects and too numerous accessories. During the last three years we have made a great number of vignettes, and in winter time have printed in scenes from negatives taken for the purpose, giving charming effects. Our customers sustain us in our decision, and no doubt it reveals all the operator's strength when he takes his sitter almost alone, having only some simple accessory to help to "tell the story."—W. J. Topley.

A great deal has been done, and very beautiful pictures made, by the mixture of the real and artificial in a picture. Although, for choice, I should prefer everything in a photograph being from nature, I admit a picture to be right when the "effect" is natural, however obtained. It is not the fact of reality that is required, but the truth of imitation that constitutes a veracious picture. Cultivated minds do not require to believe that they are deceived, and that they look on actual nature when they behold a pictorial representation of it. An educated observer does not, like that Moor to whom Bruce, the African traveller, gave the picture of a fish, believe that the artist had made a reality and say: "If this fish at the last day should rise against you and say: 'Thou hast given me a body but not a living soul,' what should you reply?" Art is not the science of deception, but that of giving pleasure, the word pleasure being used in its purest and loftiest sense. For this purpose—that is, the mixture of the real with the artificial—the accessories of the studio should receive the addition of picturesque or ivy-covered logs of wood, ferns, tufts of grass, etc., either growing in low pots or gathered fresh. It will be found easy to make up picturesque foregrounds with these materials, behind which a painted view or sky may be placed. If the background be well painted, it will be found to unite very naturally with the foreground. Care must be taken that the linear perspective be avoided, and that the light fall on the figures in the same direction as it does on the painted screen.—H. P. Robinson.

231. For despatch and convenience, it is best to have accessories arranged and waiting. In rustics, have the scenery adjusted, the rocks, stumps, stones, foliage, and backgrounds all effectively made up, with suitable openings in which to place your subject. By thus doing, there intervene no long moments of waiting. No losing heart and expression on the one side, nor a hurried, jumbled-up mess on the other. Also have at hand, books, fans, flowers, ornaments, *yellow*-tinted letters filled with suggestions with which ladies can beguile them-

a means of making them comfortable is all you can attempt. Their won drous expressions will provide the rest.

232. In posing the model, every regard should be paid, too, to the arrangement of the draperies. If a male, the folds in the coat, the wrinkles in the trowsers, and the arrangement of the cuffs and neck-wear, should all be looked after and nicely balanced. As to the other sex, there is no end to the opportunities which are given you, by their apparel, to distinguish yourself and show your knowledge of the principles pressed down and running over in Lesson A.

selves and their hands. Have canes, hats, pencils, pens, and more books, to ease off the angularity of masculines. Provide jumping-jacks, barking dogs, tin whistles, jews-harps, and a small organ to bamboozle the babies. Besides, be able *yourself* to turn into an acrobat, gymnast, or long-tailed monkey, on the shortest notice.—J. H. Kent.

The first thing I will speak of will be my baby lounge. I wanted one, but did not see anything advertised that quite suited me, so I got up one to suit my own ideas, and while it works nicely, it is not patented. I went to a furniture store and got a cheap table, similar to those used in lager-beer saloons, about eighteen by thirty-six inches top, and on casters, so as to move easily; got a board just the size of the table to nail the back and end on to; and it must be made so that the corner will face the side-light whichever way you work. Make your back- and end-board about fifteen inches high in the corner; put a small hole about the middle of the end, one twelve inches from the corner in the back-board, and another in the same line, twenty-four inches from the corner. Now upholster in drab reps or some light-colored covering, and you have a lounge you can tie on one, and sometimes you want to tie on two babies at once. You are ready for them; and another thing, they are up in a good light, high enough, so you can easily work your camera on them. Then have the mother sit down aside of the lounge so the baby can see her, but she is not to talk nor look at the child if it is quiet, and if it is inclined to be a little shy, talk to the mother instead of the child, and the failures will be few.—Forrester Clark.

232. Let us now give our attention to the drapery. The arranging of the draperies depends much upon the quality of the stuff. Thin, light stuff produces smaller folds, and plaits in greater quantity than heavy, thick, or stiff material. Furthermore, it is to be considered whether the garment covers large or small forms, or whether it hangs down loose and free. Large forms must not be interrupted by small folds, and the drapery should indicate whether the covered part is of an angular, or round, or plain, or curved shape, for all folds ought to indicate their cause, whether the same is the proper heaviness of the material, or is produced through draught, pressure, or other influences. All folds form triangles, and the reason of this is, that a garment is always trying to expand; if it is forced from one side to contract, it expands on the other side in the same measure. Folds must, therefore, never appear round or quadrangular, for the quadrangular shape is insufferable, except when it forms two divided triangles. It is also bad taste to place two folds of equal size, shape, and illumination side by side. Upon the garment of a living person, the movement of his limbs is the only cause of the position and variety of the folds. The ancients arranged large folds upon large parts of the human body, and did not suffer the same to be interrupted by smaller folds. If they were forced by the nature of the garment to do it, they made the

233. And before the lens is uncovered, and the exposure made, be very certain that the eyes of the sitter are in keeping with all the rest. They may spoil all, if wrongly directed. Once more, measure the picture by the principles laid down in Lesson A, and if it is right—expose!

small transverse folds so small and little raised, that it was obvious they could not indicate main parts.

In all cases where the garment does not strictly correspond with the naked form it covers, and does not follow the direction of the muscles, the casting of the draperies will be defective. Our modern fashion renders it often impossible to discern the shape of the body under the garment, and we are forced to make concessions to the sway of fashion; but in cases where unbecoming folds have been caused through bad cutting, or casual pressure, or draught, and the photographer could not avoid them in the arrangement, it is our task to remedy the defects in the picture. Next to the lightness or heaviness, the transparency or opacity of the material, its lustre or roughness is of importance; also its design and colors are main factors. Velvet ought to be well distinguished from cotton, silk from satin, etc. White garments and linen taken in glaring light appear usually without any medium tone, hardly, so that the shade is slightly indicated, and the retoucher has many difficulties to fill out the empty space, so that his sketchings may look natural. The photographer ought always to try to prevent this evil through subdued illumination, as the harmony in the picture is disturbed by large light masses.—HANS HARTMAN.

233. We will suppose the sitter to be the centre of a circle with diverging lines, like the hub of a wheel, with its radiating spokes. Suppose this wheel twenty feet in diameter, and the spokes one foot apart at the periphery. The junction of these spokes with the rim we will call points, like a compass.

Place the sitter at the hub, looking straight before him—body, face, and eyes to the camera ten feet away, at the outer edge of the circle. This may be called a position of neutrality, impassive, inactive. Now, the body remaining in front, the head and eyes turning to the right or left, if ever so little, there begins to be expressed activity~~, thought,~~ emotion; in which the eyes play an important part, and a part that may be largely brought under control, else there were no use describing it.

To illustrate—if the head be turned two points away from the camera, the body remaining front, the eyes to express an easy, animated, but not deeply interested attention, should be turned nearly to the third point. When the head turns from the body to the fourth point, the eyes to correspond should turn nearly to the sixth, thus expressing the same kind of easy, natural interest, but more active and more interested; and this corresponding divergence amounts nearly to a definite ratio, whether the turning be more or less, being as two to one; two of the head from the body, to one of the eyes from the face. Or, in other words, in turning the eyes to an easy point right or left, the head naturally turns about two-thirds the distance.

This ratio of divergence we will call normal, and we shall find it giving about the kind of expression generally preferred in portraiture. Moreover, we shall see that any deviation from this normal relation immediately begins to express something different, often something not at all desired. For instance, the body remaining front, with the face and eyes *both* turned *full* upon the third or sixth, or any intermediate point, there would immediately begin to appear an absorbed, deeply interested gaze, expressing anxiety, surprise, or other

234. In addition to instructions given in Lesson A, a few words may not be out of place as to the means used for securing the effects of light and shade described as the most desirable. Resort may be had to side-screens, mirrors, and reflectors, provided they are employed for legitimate effect only, and not for experiment or in wild reaches after astonishing effects hard to understand.

emotion, according to the rest of the face and action; while should the face remain fronting with the body, directly toward the camera, when the eyes turned two or three points away, there would immediately appear an uneasy, insincere, jealous, watching expression, not at all pleasant.

Varying the illustration by placing the body fronting the third point away from the instrument, while the face turned to the first point away, and the eyes into the camera, you will have an easy, direct, sincere, manly attention; while, if you place head and body both fronting point three, when the eyes are turned full upon the camera, you obtain at once shyness, coquetry, suspicion, or other similar expression, according to the other facial action. Then, if you front the body upon three, while *face* and *eyes both* turn *full* upon the camera, there would begin to appear a bold, domineering, look-you-out-of-countenance sort of expression, or similar undesirable effect.

The same principle holds good in looking upward; for instance, the head slightly raised, with the eyes about half as much more, may express spiritual contemplation, adoration, supplication, etc., according to the accompaniment, while the face remaining level or slightly drooped, with the eyes still turned upward, looking as they must somewhat from under the eyebrows, will express a cowardly shrinking, a sinister watching, or suppressed anger, according to the other features.

These hints might be greatly elaborated, but the intelligent beginner will place his camera before the sitter and multiply these illustrations to any extent. The main thing to thoroughly understand is that in every modification and turn of position, these relations of the eyes and face *will express something*, and if not controlled to express what is desired, may give expressions quite undesirable.—E. K. Hough.

234. If, then, the results of a side reflection are so disastrous, should it not be discarded altogether? We think not, and will try to show its proper use, which is to soften the shadows and make them transparent with delicate reflected lights, which, while they may oppose the principal light, yet have no vigorous contention with it, and are mere echoes of its intensity. These little reflected lights, like the reverberations of a musical sound from the walls of a room, really strengthen and enrich the original tone. Without them the shadows, even if well worked out, become rigid, and give a too solid, hard appearance to the head.

The proper effect is often produced without actually employing a white screen, but that is because the walls and objects in the operating-room take its place and supply the reflections. Their influence is always felt, and in bright weather is usually quite sufficient, if the face is placed at a proper angle to the light; unless we are taking a shadow picture, when a regular side-screen is indispensable, probably without exception.—W. J. Baker.

I have had occasion to work under high skylights, and small ones, and an expedient that I have resorted to is to use a mirror. It is a good thing to have in every studio. You can throw off the top-light as much as you like, and use the mirror, and hang it on the screens.

235. Inward and outward screens, for top and side, have already been described in Lesson J. There is no end to the way in which they may be employed, and some of the best thoughts on the subject are given in the notes. If you have once decided in your mind what is the best effect to obtain for the subject in hand, and you cannot get it by the usual means of lighting, then resort can be had to the hand-screen with much good effect during a whole or part of the exposure.

You can shut off the light from the top-light and use your side-light. You can put it on either side you please; shut off the top-light entirely, or get a little of it—enough to soften your shadows.—ALEXANDER HESLER.

235. Doubtless ninety per cent. of all the photographic studios in the world are sufficiently well lighted to allow of the production in them of good pictures, provided the light entering them is managed and directed in the best manner practicable. And in this management the arrangement of the window-curtains is of great and paramount importance, a feature which, in many cases, seems to have been overlooked or greatly neglected, and the management of the light more generally sought through the means of shades or screens, in frames, or in the hands of the operator. I am acquainted with several large establishments in which the curtains are arranged on rollers at the top or bottom of the light, both side and top, in such a manner as to render a large portion of the window *practically useless*, besides incumbering the places with a maze of rollers and cords often out of order, and requiring considerable skill and a large amount of time for their adjustment.

During the last eight years I have used, with perfect satisfaction, a simple system which allows *any* part or all the window surface to be opened or closed, as may be desirable. This is accomplished by single widths of colored muslin which run *across* the light upon small copper wire, passing through rings upon each edge of the muslin. The strips or widths of muslin should overlap each other some three or four inches, or enough to prevent any open spaces between them. The wires are readily strained sufficiently tight by using screw-eyes instead of nails in putting them up. I prefer copper wire, as its soft, tough properties offer less resistance to the twist which is caused by turning in the screw-eyes. It does not corrode, and prevent the rings from sliding easily, as is often the case with iron wire. Neither does it break in taking down, whenever the curtains need washing to remove stains or dust. In my own studio I have *two* sets of light curtains arranged by this method, one set over the other; by this means I am able to modify the light, whatever its intensity, by using either one or both sets, according to the light or cloudy state of the weather. By this system all cords, pulleys, and rollers are discarded, the curtains always remain where placed. They are easily adjusted to position in a moment's time by the use of an ordinary fishing-rod, or three-quarter inch square strip from the edge of a long board. By their use the stronger light may be admitted at any corner, or along either side or end of the window, or even in the centre when desired, as for statuary or small objects. I believe that any one, after adopting this method, will have no desire to return to any other system with which I am acquainted. Upon trial many will doubtless be surprised at the results produced by an apparently weak light fully utilized. While the light is easy and pleasant for the sitter, the chemical effect is of such a delicate nature as to far surpass all that can be produced in the flooded glare of the ordinary operating-room.—O. G. MASON.

236. At certain times of the year and day, direct sunlight, or reflections from objects altogether outside of the studio, often give great annoyance—so great, sometimes, as to render the studio useless for a few hours. If the screens and curtains do not suffice, resort may be had to coating the glass, though care should be had that the light is not retarded too much by such applications. There is this to be remembered when you apply to any of these helps in lighting the model: strive for natural effects—effects which, when accomplished, will show intent—purpose—feeling—and not serve as puzzles to the critic and mysteries to the patron. Perhaps there is more wildness shown in this matter of lighting than in any other department of photography; but, as ignorance is usually the cause of it, there is hope; and when the photographer begins to yield to the influence of the law, there is hope for him also. Pass your crudeness into the muffle, friends, and you may see it come out changed for the better.

236. A very simple way to avoid reflections of sunlight, which so often annoy us, is as follows: Cover the obnoxious panes with starch-paste until they are dull or half transparent. It may be put on thick or thin, and in winter, when the sun is low and all the light is wanted, warm water will remove it. Starch-paste is a good thing to stand by, and it secures a very complete union between card-board and paper, but, as some do not like it, the following may be of use for producing a good white paste (it sticks like the shirt of Nessus): A solution of two and a half ounces of gum-arabic in warm water is thickened to a paste with wheat flour; to this add a solution of alum and sugar of lead, seventeen hundred and twenty-eight grains each, in the water, is heated and stirred about to boil, and is then cooled. It may be thinned, if necessary, with the gum solution. Blue-frosting used to be a great favorite among photographers, but I rarely see it now upon a skylight. I frequently see the slovenly remains of it; and, as it seems to be difficult for some photographers to get it off their glass, I would recommend the following as very effective: Soft-soap mixed with a solution of potash or caustic soda, or pearlash and slaked lime mixed with sufficient water to form a paste. It may be laid on with a brush or rag, and when left for some hours will render the removal of blue-frosting very easy.—J. Grasshoff.

LESSON L.

MANAGING THE MODEL.

237. The studio may be constructed in the most skilful, workmanlike, and expensive manner, and yet be wasted upon its owner, unless he be possessed of skill sufficient to manage it. Experience, actual and hard, only can supply this; but it is a fascinating study, and if prosecuted with feeling, it will reciprocate and repay to your entire satisfaction and delight. The posing and lighting, or managing of the model, then, must not fail to have consideration here.

238. Direct, diffused, and reflected light are the three qualities or forms which are to be moulded or managed by the skill of the photo-artist, to produce the results he desires. The first needs the most careful hand-

237. Light is the element of life, the drawing-pencil of the photographer. It is the brush with which he paints. For him a thorough knowledge of this element is as important as it is for the painter to possess an exact knowledge of his colors.—Dr. H. Vogel.

What requisites must I have to do as good photographic work as can be done at our present stage of enlightenment, is a question finding lodgment in every true photographer's mind of to-day. We believe that first of all we must have a *good light*, and experience enough to know how to use it, and what its capabilities are. In defining a "good light," I would say the one is best which will work the most uniform, and needs the least array of curtain appurtenances, and is most simple to manage.—Mrs. E. N. Lockwood.

Light is an emanation, or something which proceeds from bodies by means of which they are made visible. All bodies may be divided into self-luminous and non-luminous. Self-luminous bodies are those which have the power of discharging light. Non-luminous bodies are those which have not the power of discharging light. One non-luminous body may receive light from another non-luminous body and discharge it upon a third; but the light must originally come from some self-luminous body. When a lighted candle is brought into a dark room, the form of the flame is seen by its own light, and the objects in the room are made visible by the light which they receive from the candle and again throw back. Those objects on which the light of the candle does not fall receive reflected light.

A diffused light will not give you shadows; it will not give you roundness; it will not give you any relief; it will not give you form, because, if you could light everything here in this room, all exactly of the same strength, it would be just like a piece of white paper, there would not be anything like form to be seen here. If you light the form of the column on the wall just as light on this side as on the other, there will be no shadow there. If you light the centre of it as much as the edge, you will not see any form at all.—A. S. Southworth.

ling and judicious application; the second is of the most service, and the last comes in as a helper in time of need, for reasons that vary with circumstances, but usually to supply light where it cannot otherwise be had.

239. Various as are the effects procurable under any skylight, just as varied are the means employable to produce them. Shade as well as light is necessary to secure roundness and brilliancy of effect. There should be gradation from one to the other, and also a complete harmony between them. Contrast to a moderate degree is requisite, and now and then masses of light may be used, and of shadow as well, to secure the most charming effects.

239. It is a rule with portrait painters to represent their sitters in a light, falling from the side, at an angle of about forty-five degrees. This gives the best light for the majority of faces, and to secure such a light should be the aim in constructing the light for a studio.—L. G. Bigelow.

Of the importance of effectively "lighting the sitter," there will not be two opinions amongst photographic *artists*, therefore our hints will tend to show how this desirable end may be attained, rather than to discuss the principles upon which it should be based. Yet, we would say, in passing, that a monochrome picture must necessarily depend more upon its effect of light and shade for producing lasting pleasure than upon any other quality. This is a point upon which photographers would do well to ponder. Why is it that a photograph or print, which at first struck you as possessing considerable merit, does not continue to yield a feast to the eye? The pose and expression are good, the manipulation is in all points satisfactory, and yet you soon grow tired of it. Is it that the subject is uninteresting? By no means. The idea is as happy in its conception as in execution. Why, then, does it not continue to give satisfaction to the mind? Just because it lacks that charm which harmony of light and shade produces. What is harmony of light and shade? Of sound and color—you can understand that term; but of mere light and shade—what does it mean? The term as applied to sound means concord, agreement; and why should this not apply to a scale of shades, from the faintest to the deepest, and their blending together so as not to irritate the sensitive eye? Yet, it is not, after all, a mere harmonious scale of sounds which gives pleasure to the ear, but the skilful use of these sounds, contrasting, blending, epeatring; so with the scale of shades in a picture, they must be worked into a tune, and the more skill and "feeling" exercised in doing this, the more lasting will be the pleasure excited.

What we want, then, in the first place, is a highly cultivated as well as natural perception of this kind of beauty. And, in the second place, we want the means at our disposal for thoroughly carrying out our conceptions of it. It is to assist in the accomplishment of the latter that the above was written.—J. M. Burgess.

Suppose a ball to be the object on which the light falls in a direction of forty-five degrees, or the diagonal of a square, and at a right angle from the ball to the place where you stand, one-half the ball will appear illuminated and the other dark. This state of the two hemispheres constitutes the two masses of light and shade. In the centre of the mass of light falls the focus of illumination on the ball, between the centre of the illumination and the circle of the ball. Where the illumination reaches its extremity, lies what may be called

240. "And when her royal highness, the model, presents herself to me for a pose, how am I to know how best to treat her?" queries the photographer mentally. Here again comes good your intuitions—the power of inspiration which you must cajole into your service. Never allow yourself to falter, any way, at such a conundrum. If you have heart for the work, the ideas will come to you, and the first lesson of this book is ever at your service. You should be full of it before you face any sort of a model.

241. In managing your curtains and reflectors, act not wildly. *Naturalness* is what should be sought after, and it is a mistake to light a model

the transparent tint or shade: and between this and the dark side lies what is called the aerial tint or middle tint. The point of darkness, the extreme shade, is directly opposite the focus of illumination, between which and the aerial tint lies the tint of reflection or reflected light. If the ball rests on a plane, it will cast a shadow equal in length to one diameter and a quarter of the ball. That shadow will be darker than the shade on the ball, and the darkest part will be where the plane and ball come in contact.—M. A. DWIGHT.

240. I think the first thing in posing, practically speaking, is to take a rapid survey of the sitter, a lady, for instance, to decide whether we take a full or three-quarters length; a sitting or standing; head and shoulders; which side of the face is best; which side of the dress, etc., is most effective, and thus try to secure the portrait having most personal characteristics in it, because we know many persons are recognized by their "walk as well as by their conversation."—W. J. TOPLEY.

In studying faces our aim should be to find out what view or light best becomes it. This should be a constant study in every gathering of people that we see; we must search for effects of light and shade, and beauty and harmony of form. When a sitter enters your studio, at once look him over, read him, watch for anything pleasing or beautiful, and when he comes to your chair, use all your art to catch and hold it.—ALEXANDER HESLER.

It appears that many photographers lose sight of the fact that the parts of the face farthest from the eye should be darkest in tone, and the parts nearest should be the lightest, with a gradation of tone from the light to the dark parts. I have seen many photographs by those high in the profession, in which the reverse of the above is strikingly observable, that is, the back part of the cheek would be lighter than the front part. By a little thought, you will see that this is an error.—FRANK JEWELL.

I think expression in a portrait of the first importance, and I consider that a master portraitist should be able to infuse any expression he chooses into a portrait. Expression belongs to the whole body as well as to the face. I have often thought I should try to produce a picture, the story or meaning of which should be plain, by using lay figures or marionettes only for the models, the whole story being told by the position and action of the figures. How is it that so many photographers seem to have but two or three positions at most for their sitters?—O. G. REJLANDER.

241. The dress should give a mass either decidedly above or below that of the background. If above, care should be taken that it does not overweigh the light mass of the face, and sink the most important part of the picture into insignificance. With care, almost any

in any striking, fancy way which never occurs in nature. You are to strive for *likenesses*, and not distortions and caricatures. Therefore, study the light effects upon face and figure, and *then* go to your ground-glass. The drapery too is of great importance, and the background must also have careful attention. Indeed, *thoughtful care—all through.*

white drapery can be used, and particularly with the shadow picture gives beautiful effects. Turning the shoulders from the light, shielding the dress from the light by an opaque screen, subduing the general illumination, are very effective means for producing softness and securing detail in white drapery.—W. J. BAKER.

The whole system of lighting a subject for a photographic portrait is contained in the following sentence: The light must be properly balanced, the exposure sufficient to bear out the lighting, and the development regulated to the exposure. No one of these three items can be in error without destroying, with mathematical certainty, the *perfect* result. You may *approximate*, and produce *good* pictures, but not the *best*. Place a sitter under an uncurtained light, even in the most favorable position possible, and we at once see that one side of the face is in a very strong light, and the other in a very strong shadow. We can hardly see any detail in the shadow, except we squint the eyes and shut out the volume of light which confuses our vision (as it will also that of the lens), then we see some of the details. Now, take a large card-board and hold it to the side of your face, nearest the direction from which the light comes, and hold it also in such a manner that you see only the shadow side of the sitter's face, and observe how, at the instant the light side of the face is obscured by the interposition of the card-board, the shadow seems to lighten and become transparent. We perceive at once, from this experiment, that the shaded side of the face is not in the deep shadow it seemed to be, but that the force of contrast caused it to *appear* so; and *practically*, for all purposes of photography, it *is* so, for we cannot make our lenses squint. You will see by this that by balance I mean an even illumination or light, so managed that the contrasts shall not be white and black.—L. G. BIGELOW.

The grand point for those who have not paid sufficient attention to this most important of photographic questions, is to accustom the eye by constant watching—out of the studio as well as in it—for any unusual effect of light on the human face which may happen to be pleasing, and at once to analyze, as far as possible, the cause. I shall best further my object, before I speak of special studio arrangements, by describing two extremes of light, one favoring perfect relief, but with contrasts too strong for general photographic purposes, and the other —unfortunately, too common among photographers—producing flatness and almost total absence of texture. By putting these two extremes side by side, I shall the more readily make clear what I desire to say. Those who have been in the studio of the sculptor for the first time will have been struck by the wonderful delicacy and relief of any work in marble which may happen to be in hand. Should his curiosity lead him to watch the effect of the same kind of light on the human head and bust, he will be equally delighted with the novel effect of light and shade before him. He will notice a delicacy and texture quite unusual in ordinary lights, combined with the most perfect relief. The whole effect will be most striking and forcible; but after some time spent in close observation, he will find that, whilst the high lights and those next approaching to them are wonderfully rendered, the deepest shadows, and those allied to them, are much too heavy for photographic purposes. The observer will feel less of this, however, if the subject examined should happen to be a blonde dressed in

242. The time of exposure must next be considered. Too much impatience is indulged in here. *Take enough* exposure, whenever the subject in hand will permit it. Do not *under* time, if you can help it. To secure the proper brilliancy and charm of effect, *time* must be given. *Effect* first, and time afterwards is the rule. Yea, *effects* at *any* sacrifice, rather than sacrifice them for the sake of rendering it a little easier for your model. If there is a prevailing fault among photographers, it is that of undertiming.

light drapery. A little investigation will therefore show that the marble, being a semi-transparent substance, permits—indeed requires—this strong treatment in order to produce the proper amount of relief, and that, in the case of the blonde with the drapery light in color, the shadows are softened by the reflections carried into them, and thus reducing their intensity. Every one must, at some time or other, have been struck with the wonderful effect of relief combined with perfect transparency in the half-shadows, when a lady, dressed in a very light diaphanous material, has chanced to be placed near an open window in a well-lit room. The effect is totally different if a swarthy, black-bearded man, in the mournful livery common to this age, should happen to be seen under precisely similar circumstances. In the latter case there are no reflections to help out the effect; hence the difference. I may say here that the most perfect effects of lighting I have ever seen have been produced at a lofty side-window, the lower portion of which was covered with semi-transparent material, a suitable system of reflectors being used to carry light into the deepest shadows to lessen the contrast.—VALENTINE BLANCHARD.

242. It is an unquestionable fact that the most brilliant image on the ground-glass is produced by lenses having the smallest reflecting surface adapted to a well-blackened camera. It is, also, evident that, when all the rays but those forming the part of the image depicted on the ground-glass are excluded by means of a hood or cone, the image will gain in vigor and brilliancy. The question whether it will not, in certain cases, be an advantage to sacrifice some of this brilliancy for the sake of rapidity of action, is one which is submitted to the thoughts and consideration of photographers.—CHARLES WALDACK.

Pictures taken with an appreciable exposure are, according to the experience of the writer, successful in far larger proportion than those done very rapidly. As examples may be quoted the now well-known shadow or Rembrandt pictures, having a large part of both face and figure in shadow. From the light being admitted only from a contracted opening in doing these photographs, and the illumination of the shadow portion being derived only from a reflector, a far longer exposure is requisite than for the usual class of pictures, yet does an unprecedented success attend their production in their great approval by the public. It is in the expression that the great power here lies; the larger proportion of the face is simply illumined by a very soft light, giving complete repose of appearance, and, at the same time, rendering very easy the operation of sitting, which is often felt by sitters to be so painful.—SAMUEL FRY.

Let those who are not satisfied with their results proceed to cover up their top-lights and windows with very transparent material, say tracing-paper, or, better still, a mixture of flake-white mastic varnish and turpentine, until the pure light admitted on the sitter from the top and side, at an angle of forty-five degrees each way, does not exceed eight feet square for a tolerably lofty studio, and even less than this under some circumstances, and I am

243. There are various "dodges" practised for the shortening of the exposure, and, as will be seen in the lesson on the manipulations of the plates, there are "quick" processes given. They are of questionable advantage if the best effects are desired. It is well, however, to have all these things in mind, and, therefore, record is made of enough of them to serve all emergencies.

assured they will be astonished to find that, whilst the exposures are not increased in any material degree, the difference in the results produced will at once prove the advantages of the "dodge" advised.—VALENTINE BLANCHARD.

243. The dodge of allowing the light to act slightly on the plate, to be able to do with a shorter exposure, is, however, not to be despised, and made use of intelligently, will do good service. A means which is communicated to me by a friend, and which I have not seen published, is to cover the largest stop with white paper, and cut out an opening the size of the stop generally used. The result is a softer negative, with one-third or one-half less exposure than if the opaque stop had been used. This action of diffused light lighting up the image, and thus reducing the exposure, often takes place when the photographer is not conscious of it. Years ago, when it was customary to make negatives of vignettes against a white background, it was found the exposure was considerably reduced. Again, the image may be lighted by reflection from the sides of the camera and from the surface of the lenses. The lighter parts of an image, the sky, for instance, will reflect diffused light on the inside of the camera, and thus light up the darker parts. Any landscape photographer may have observed that a view with much sky will require a less exposure than one from which the sky is nearly excluded. We all know that long exposure reduces contrast. Suppose we have before the camera a country residence, with overhanging porticos illuminated by a strong summer sun. The contrast is painful to the eyes; and still, by giving a sufficiently long exposure, we can reduce it so that the house appears to be bathed in the mellow light of an Indian summer day. How much of this may be owing to the diffused light reflected from the more illuminated parts?—CHARLES WALDACK.

I am now, and have been for years, using my camera lined with white—white writing paper. The shadows are not so hard and black, and altogether a much more engraving-like effect is produced. If the reflected light in the camera is not sufficient, it is well to expose the plate two or three seconds through the lens to a sheet of blue stuff, placing the stuff in a diffused focus, either before or after the picture is taken. This plan renders the shadows soft and gray, doing away with the hard black shadows which have been so damaging to the patronage of the photographic art. In addition to all these advantages, the camera lined with white will produce pictures quicker by at least ten seconds in the minute.—JOHN EASTHAM.

Difficulty sometimes occurs when groups are to be made of persons varying in complexion. It may be overcome by giving the group the proper exposure for the light subject, and then capping the lens, and allowing that one to leave the group; then continue the exposure as long as is required for those remaining. Care must be taken that this change may be readily accomplished without disturbing the position of those requiring a long exposure, and to have no light or white drapery behind the one who is first to leave, because, if dark clothing was in front of it before the change was made, the light drapery would show. A black cloth may be used to conceal what was before covered by the sitter.—E. Z. WEBSTER.

LESSON M.

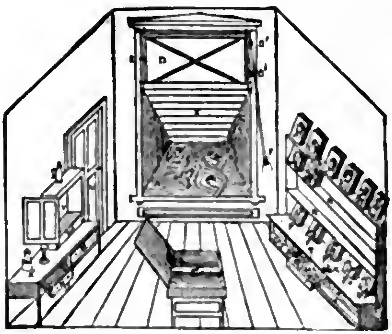
PRINTING ON ALBUMEN PAPER.

244. After the negative is entirely finished, the important operation of printing proofs from it next occupies our attention. And right here the student needs to call up his best thoughts and exercise his utmost care. A few years ago, it was imagined that "any supernumerary could print," and not much attention was given to this department of photographic art-work. Now, however, the tables are turned. The head-printer in a well-organized establishment ranks with, or next to, the chief operator, and the work of the one requires the exercise of as much taste and skill as the other. The printer should be allowed everything of the best quality to work with, and have a comfortable room to work in.

244. A photograph printer is worth his price just in proportion as he uses care in his work. The printer must be held responsible for his silvering, printing, and toning, with no redress. He cannot lay the fault upon the negative maker, nor upon the toner. If he understands his business, he is invaluable. If he does not understand it, he had better turn his attention to something else, for I boldly assert that the photograph printer is the most important man in a gallery.—I. B. Webster.

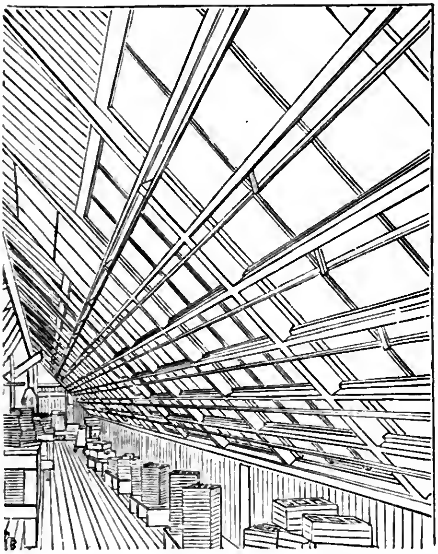
The size of my printing-room is 10 x 15 x 10 feet. A is the printing-shelf, upon which the negative-boards are placed out to print; B is the sash of glass through which the light enters on the shelf, and which sash is kept in place by the hooks, C; D is a window, which swings back and forth by means of the hinges D′. This window, when closed, is fastened by the button, E. This window was arranged to permit the printer to open it in the winter time and sweep the snow from the glass, without the trouble of removing his frames, and then taking the sash of ground-glass in. There is another sash of plain glass made, which is placed out instead of the ground one, when it is so desired by the printer. F is the window-cord by which the sash is pulled up or let down. G is the drawer in which the albumen paper is placed when it is ready for printing; H is the drawer into which the prints are slipped through the little aperture K, which is cut in the bench, and supplied with a

Fig. 57.



245. It is a common fault, among employers especially, to devote too little attention to the construction of the printing apartments. They should be roomy, well exposed to the south, well ventilated, clean, well accoutred, and provided with the wherewithal to produce results of the best quality. Probably one of the best models was that constructed by the Centennial Photographic Company, at their studio in the International Exhibition grounds, in 1876. A drawing of a section of it is here given, more especially to show the arrangement of the rests for the printing-boards during exposure. A portion of a graphic description given of it at the time is found below. Of course, few need such large printing quarters, but useful hints for the construction of smaller ones may be drawn from this. The great trouble with many printing apartments is, that they are neither roomy enough nor convenient. Again, they are

Fig. 58.



cover of tin or zinc; this arrangement saves opening the drawer so often as to discolor the whites of the prints therein contained; L is the drawer in which the albumen paper is kept. M is a drawer in which the plain salted paper may be placed, and in it is another drawer in which the *unsalted* paper can be placed; P P are negatives which are to be printed, and which, when they are printed, are temporarily placed at P′, until they are filed away, which is done in another room. The shelves, R R R, are also negative shelves, which are used for special purposes, such as the "family negatives," etc. The wide shelf is made for the storing away of negative boards, vignette blocks, porcelain printing-frames, etc., all of which are kept *in order*. The filling of the board is done on the bench, T; U is the door leading to the silvering- and toning-rooms; V is the fuming-box, which will also be explained further on; W is the box in which the old or used hypo-bath is poured, and zinc thrown into it; X is a bench which is used for one thing and another, also for keeping bottles, etc., upon.—C. W. HEARN, *in the Practical Printer.*

245. The exposure was southern. It must have been at least a hundred feet in length, probably more. There was a railing running around the whole of it, and a projecting roof above. It must have been Mr. Wilson who conceived the idea of adapting the southern exposure to printing purposes. Large sashes were fitted from the roof to the balustrade, inclined at a slight angle, the ends were protected by partitions, and the result was a long, magnificently lighted apartment. The side-screens, of tissue-paper, were so adjusted as to

not provided with the proper means of placing the printing-boards at a proper angle in the light, and no plan is arranged for screening them or for protecting weak negatives from too strong a light while printing. Finally, the cold should be guarded against by some arrangement that will enable the room to be closed in winter without losing light.

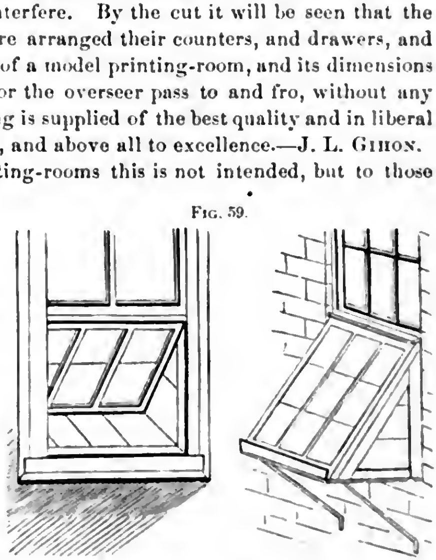
246. In printing from the negative, one is subjected to as many annoyances and failure-causes as in making it, but the operations are so beautiful, and the results so charming, that if the heart is put into the work, —if you make *yourself* a part of it,—there is sufficient in it to excite your

be made serviceable for changes of light, and racks placed immediately under the windows, as high as the hand could reach, for the support of the printing-frames.

The racks for the printing-frames at the windows are plainly shown here; they are permanently fixed under the sash, and of such width as to suit the largest measure of printing-frames, and made so as to hold the printing-frames both at the top and bottom, at the proper angle to the sun. In the inside printing-room the sashes are hung on a swivel so as to change the angle; but those in the portico or outer printing-room are permanent. All the printing, or nearly all, is done under tissue-paper; this is a slow method, it is true, but the results are far superior, and as superiority is the principal aim in this establishment, but little regard is paid to anything that will interfere. By the cut it will be seen that the printers stand side by side, and behind them are arranged their counters, and drawers, and changing-boxes, and all the other conveniences of a model printing-room, and its dimensions are so great that one may pass by the other, or the overseer pass to and fro, without any interference with the work, and while everything is supplied of the best quality and in liberal quantity, yet due attention is given to economy, and above all to excellence.—J. L. Gihon.

For those who have regularly fitted up printing-rooms this is not intended, but to those who are still printing by the "cold, open window," it will surely be a boon. Having a platform outside of my window, just as a good many others have, some three feet by four, I conceived the idea how easy it would be to get a sash made to fit. I got one that just reached from the outer edge of my platform to the lower edge of the upper sash of my window. I then had the ends enclosed, and the whole fitted up; putting in glass just as in my skylight. My window will hold from fifteen to eighteen negatives, and can print in all kinds of weather. Every artist knows that prints are very much improved by keeping them warm; then it is so comfortable, and removes much of the unpleasantness of the work in winter time.—J. S. Young.

Fig. 59.



It is much to be desired that more intelligence be imparted into the printing operations, for it is only reasonable to expect that if it be impossible with one negative nitrate bath of inferior strength, with one kind of collodion more modified, and with a developer of unvarying

ambition, to fascinate you, and to repay you for all the pains you exercise in order to produce the best possible results. Indeed, the negative may be ever so perfect and good, yet the printer may spoil all if he is heedless and indifferent. As the artist who makes the lovely sketch upon the block is so often disappointed by the murderous hatcheting of the engraver, so is the negative-artist sickened by the careless handling of his work by him who should be equally an artist—the printer. There should be a harmonious working—a mutual understanding—between the two; they should *operate and think together*.

247. The best results are obtained on albumen paper, which is supplied of various excellent brands, ready made, by the dealers. Few under-

proportions, to produce every variety of effect in the negative, so is it equally impossible, from paper always the same as to the proportion of albumen, salt, and silver, to get perfect proofs from all kinds of negatives as opposite in their characteristics as photography can make them.—VALENTINE BLANCHARD.

246. I have used this bath for six or eight months without having it once hardly more than perceptibly discolored, even after a hard day's work. It is made as follows:

1.—Nitrate of Silver,	40 grains.
Distilled Water,	1 ounce.

To every eighty ounces of solution add of a

Saturated Solution of Sal Soda,	½ ounce.

Upon adding the sal soda, the bath will turn creamy in color; let it settle for a while, and then filter the decanted solution. There will be a deposit in the bottle, which will take the organic matter from the bath, and render the solution always clear. This deposit, which is the carbonate of silver, should always remain in the bottle, and the solution poured into it after use; then shake up, and it is ready for use again in a very short time. By the use of this bath the solution will always be clear, and the only thing required in its management is to add solution from a stock to keep it up to some number of ounces—eighty, for instance—and every few days add a few drops of the sal soda solution. It is an excellent bath.

2.—Nitrate of Silver,	35 grains.
Nitrate of Ammonium,	35 "
Distilled Water,	1 ounce.

Filter this solution through filtering-cotton, after having placed a piece of alum about the size of a small filbert in the funnel, and then the solution will take up some of the alum, which it surely needs.

This alum, by the way, is one of the best things that can possibly be used in the bath outside of the silver, as all photographers who have used it can vouch for. Both it and nitrate of ammonium, besides coagulating the albumen on the surface of the paper, also improve the tone of the unfinished print, giving remarkable richness and beauty to the whole print, thus rendering it an easier thing to obtain finer tones, although still considerable skill is required. —CHARLES W. HEARN.

247. The negative having been obtained, the next step is to produce positives from it. The fact long known to man, that nitrate of silver in the presence of organic matter darkens

take to albumenize their own paper, so no instructions as to that are called for here. The sheets of paper are taken in the hands and floated carefully, albumen surface down, upon a solution of nitrate of silver made as follows:

Water, ...	16 ounces (fluid).
Nitrate of Silver, ...	2 "

Dissolve the silver in the water, and separate one-fifth from the rest. To this add liquid ammonia until the brown oxide of silver is redissolved, after which it should be added to the remaining four-fifths. Oxide of silver will again be precipitated; this should be redissolved again with chemically pure nitric acid, being careful not to add too much. This will leave the solution slightly alkaline. It is not liable to turn red, unless it is allowed to get exhausted.

in sunlight, is utilized for this purpose. In darkening, it is probably reduced to a subnitrate, but why it should be reduced, and why in the presence of organic matter, is a question that will not be proposed here, because its answer would lead so far into the fields of theoretical chemistry that we might find ourselves more in shadow than before we entered those holy domains. The fact is certain, that the nitrate does darken when exposed to the sun, and it is also true that this fact is utilized in obtaining positive prints. The paper is first albumenized, because it gives a fine, smooth finish to it, and allows it at least to work as fast as the plain paper. When this is floated upon a nitrate of silver bath, albumenate of silver is formed; but as there is also free nitrate of silver present, and as it is a so much simpler salt, and as the reactions are similar, we will consider it as nitrate of silver in the presence of organic matter—albumen. A piece of paper is then taken, with a coating of albumen, and coated with nitrate of silver and allowed to dry. If now this is used to print with, it would be found that the reaction would be retarded by the nitric acid that would be set free (nitric acid being liberated in this case in the same way that we have seen chlorine, bromine, and iodine liberated before). Something is evidently needed to seize upon the escaping nitric acid, and by uniting with it prevent it from doing any damage. This "consummation devoutly to be wished" is obtained by the "fuming," when the sensitized papers are hung up in a box and subjected to the fumes of ammonia. Those fumes, acting upon the nitrate of silver on the paper, form with it ammonia-nitrate of silver. So then when the paper is placed under the negative, and the light acts upon it, and in acting upon it disengages nitric acid, this nitric acid instead of escaping, instead of retarding the action of the light, seizes upon the ammonia, forms nitrate of ammonia, and then as a retarding agent its work is at an end. The sensitized paper having been exposed for a sufficient time is, as every one knows, taken from the printing-frame and washed in water; washed so as to remove the free nitrate of silver; after being washed in several changes of water it is transferred to the toning-bath.—H. M. McIntire.

The strength of the positive bath must be regulated by the strength of the negative. The stronger the negative, the weaker the bath may be. For a moderately strong negative, the bath may be between sixty and sixty-five grains to the ounce. Very thin and weak negatives require a bath of seventy to eighty grains.—Elbert Anderson.

248. As the solution becomes reduced in strength, always add pure crystals of silver, and not a stronger solution of ammonia, as some recommend, as in that case the ammonia soon becomes in excess, and is liable to dissolve off the albumen. The proper plan to adopt is, as the solution is reduced in strength, to add pure nitrate of silver, and, when it is reduced in bulk, to make a fresh supply according to the formula, and mix them together; this will keep your solution at a certain standard all the time. The paper should be floated on this solution from one to three minutes, according to the density of the negatives in use. Take just as much care of this solution, too, as you would of your negative-bath solution. When not in use, keep it covered up from the air and dust, or

Now paper requiring a bath of one hundred grains should contain, for each unit of surface, two and a half times as much of the soluble chloride as that requiring a forty-grain bath. It follows, then, that each sheet silvered on a one hundred-grain bath should convert two and a half times as much silver as the forty-grain bath, while the free nitrate of silver withdrawn from the bath by the paper will contain the same proportionate excess. It will not be much out of the way to say that an ounce of silver made into a forty-grain bath will silver two and a half times as many sheets as the same quantity of silver in a one hundred-grain solution. This is on the supposition that the strength of the salting varies in the same proportion as the silver. The one hundred-grain bath will give more free nitrate to be washed from the prints, and more unreduced chloride to be removed by the fixing-bath.

It is a matter of no small importance, on the score of economy, whether a strong or weak solution is used, *provided*, as is claimed, the weaker solution is *not* used at the expense of some quality of excellence in the resulting picture. But, as above intimated, much depends upon the preparation of the paper, for the salting may be such that a forty-grain bath would dissolve part of the albumen, sufficient to impair the brilliancy of the print. Suppose a paper salted with a chloride whose base gives a very deliquescent nitrate which has not the property of coagulating albumen. It is probable that, on floating this paper on a forty-grain bath, so much silver would be converted into the chloride from the solution in immediate contact with the surface of the albumen, that the impoverished solution, aided, it may be, by the new nitrate, would dissolve a portion of the albumen. In such case the silver bath must be strengthened, and I remember to have used paper that for the best results required a bath one hundred and twenty grains strong.—W. H. Sherman.

248. When a new bath is made, add about half an ounce of ammonia to the gallon. The precipitate of oxide of silver is left on the film, and will dissolve when the bath is filtered again after it has been used for ten or twelve sheets. If at any time discoloration should appear again, look to the strength of your solution, and use a few drops of ammonia. The ammonia added to the printing-bath produces, to a more or less degree, the effect of fuming, according to the quantity which is used. How or why the addition of ammonia prevents discoloration, I am unable to tell. *Per contra*, if the bath be very strong, the solution will repel from the surface, which will look greasy, the liquid collecting in drops.—Charles Waldack.

Take nitrate of silver, fuse it, dissolve it in the necessary quantity of water, put it in the sun for a few days, and filter it. When tested, now, with litmus-paper it will turn red paper

else nightly pour it into a bottle where no contaminating influences can reach it. It will treat you well if you are good to it, and reward you with splendid results.

249. A few words as to the manner of sensitizing or floating the paper. First, turn up the corners of the sheet, albumenized side down, so it may be readily handled by them. Now seize the sheet by the two diagonal corners, and allow it to fall or curve, the right end being lifted the

blue. Now add C. P. nitric acid, enough to turn a piece of blue litmus-paper red, say within ten or fifteen seconds. Let it stand for a day or two, and throw into it precipitated chalk (ten cents' worth will go a long ways; an excess will do no harm). After a day or two, during which time it must be well shaken up once in a while, filter it carefully, and you will find that this silver solution will not turn blue paper red, and yet work rapid and without fog. I forgot to state that it has to be saturated with iodide of silver, as usual. Chalk is also good to use in discoloring silver solution for silvering paper. I always keep some in my funnel, through which I let the solution run after being used.—R. Benecke.

Let me say that you may, on the utilization of old negative baths for printing, take any old negative bath, no matter if it fogs or has been overworked. If acid, neutralize either with carbonate of soda or liquor ammonia, a slight excess of alkali does not matter, and set in the sun for an hour or so; if there is no sun, keep it in the light as long as you can. The object of this is to precipitate all organic and other impurities, while retaining the alcohol in the solution. When sufficiently sunned, add one drachm of a solution of citric acid (sixteen grains to the ounce of water) to every eight ounces of bath solution. The object of this is to precipitate the iodide of silver in the bath. Filter, and add fresh silver until the solution contains thirty-five grains to the ounce. Now, to every half gallon add half an ounce of muriatic acid; shake well, then add enough liquor ammonia to make it slightly alkaline; again shake well, filter, and save the filtering-paper for subsequent use as long as you can. Every time you strengthen, add a little acid and ammonia. Float the paper from thirty to forty seconds; *no more.* Fume as usual.—J. L. Gihon.

249. For silvering the paper, provide a table, somewhat larger than the sheet of paper, covered with velveteen. Upon this the paper is laid, and the albumen surface is briskly rubbed with a bunch of cotton or, better, with a soft pad covered with silk. The pile of the velvet upon which the paper is laid serves to hold it from slipping. The rubbing prevents the silver solution from drying in drops or tears, which frequently occasion great annoyance. I imagined the effect produced by the rubbing might be due to electricity, and this idea suggested silk as a substitute for the cotton. I prefer the silk, but the electrical question remains undetermined. The paper is then rolled up in the form of a scroll, which is held in the left hand and placed upon the solution (previously poured into a pan of suitable size), while the free end is drawn over the surface by the right hand, the unrolling being regulated by the left. This manipulation being skilfully performed, the possibility of the formation of bubbles on the paper is precluded. In warm weather, the paper is left in the solution about one minute; in cool weather, two or three minutes. The paper is then lifted slowly from the bath, so that but little of the solution is drawn up by cohesion. Lastly, it is reversed and hung up to dry by the end which was last to leave the bath. Hardly a drop will leave the paper after it is suspended.—W. H. Sherman.

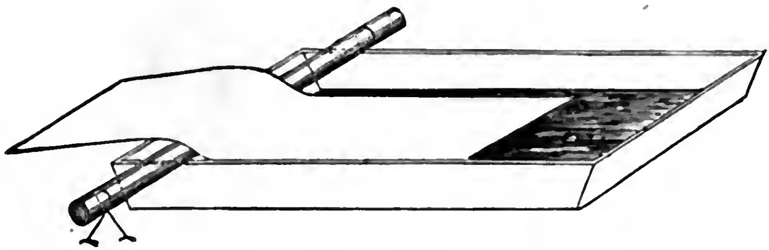
highest. Now drop the left end of the sheet upon the surface of the solution, and by one of the corners carry or float it to the left end of the vessel, following with the other hand, gradually dropping the sheet, and with the fingers tapping gently upon the back of it until the whole lies upon the solution. Avoid bubbles. Do not allow the edges to become immersed, and if they turn up, breathe upon the sheet, and that trouble will end.

The following is a neat and economical method of treating the silvered sheet when taking it from the solution on which it has been sensitized. Have ready as many sheets of *thick* blotting-paper as there are sheets of paper to sensitize. In lifting the albumenized paper off the silver solution, draw it uniformly over the edge of the dish, so as to remove as much as possible of the solution adhering to the surface. Lay the sheet on the blotting-paper, and place another sheet of blotting-paper over it to still further absorb the superficial solution. Lay the next sensitized albumenized sheet on this blotting-paper, and so on, alternating blotting-paper and sensitized albumenized paper. The thick blotting-paper quickly takes up the nitrate of silver solution, leaving the sensitized sheet with no free moisture. In this condition it quickly dries without the silver solution gathering in pools or drops. The sheets of blotting-paper can be used many times before they become saturated. They may then be burnt for the silver they contain. To those who have not tried this method, two objections appear obvious—that the prints from such sensitized paper would be weak by having so much free solution removed from the surface, and that the sheets would be dirty. In practice, however, the paper so treated is found to give quite as vigorous, and much more uniform, results as from paper that is lifted direct from the dish and hung up to dry spontaneously. If care be taken with the blotting-sheets, no marks whatever will be produced by the damp contact of the two papers. There are many advantages attached to this mode of working—superior cleanliness, by the absence of the stains of drops of silver solution; less time required in drying off the sensitized sheets; the economy of the silver, for the expense of the blotting-paper is as nothing compared with the perfect method of saving the whole of the silver solution adhering to the sensitized sheets. I am not aware of any drawbacks to this method. I have had it in use for several years.—JABEZ HUGHES.

When floating paper, I, as a rule, bring one end of the paper in contact with the silver solution first. Now, after carefully removing all air-bubbles, and allowing the paper to float as long as I deem necessary, I first lift the end of the sheet from it that was the first to come in contact with it. This gives a uniform coating, and assures me that some parts of the paper will not be more brilliant than others, and that the prints next day will be uniform in strength and brilliancy. If one is good, all will be good, and *vice versa*, provided always that care was used in the printing. Do not rush the paper off of the solution, but raise slowly and evenly, which allows the silver to run off the paper while raising it, so that when it is completely off, there will be only a dropping from it. Now hang the sheet with one corner lower than the other, under which place the silver bottle, in the neck of which is the funnel with filter. While preparing another sheet of paper, this will have dripped as much as it can, and is now ready to be moved to another place to dry, leaving room for the next sheet. In this way very little silver is lost or wasted; and not only is this the result, but the paper is in better condition—from the fact of its having been through a certain routine—

250. To remove the sheet from the solution requires some care. Seize it by the left corner nearest you, and slowly raise it until the opposite left corner is free from the solution, when the last should be taken in the

FIG. 60.



right fingers, and then the whole sheet is gently lifted from the dish, allowed to drain, drawn over a glass rod at the end of the dish, and then hung up to dry. By this means the superfluous silver solution is saved for future use, instead of being allowed to drip on the floor and waste, and the uniform silvering or sensitizing of the sheet is more certainly effected. The movement over the rod should be slow and even, with rather a dragging or pressing against it outwardly, rather than a motion more vertical. Some do not use this glass rod, believing that it abrades the surface of the paper. This can hardly be true, however; neither can it deprive the sheet of any needed silver. If it *is* used, care should be taken that no marks are caused by hesitating, in the least, while the sheet is being drawn out and over the rod. The time of floating varies with

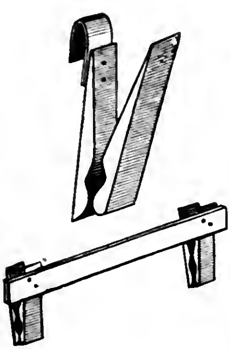
which results in making it more general in results. The surface of albumenized paper should never come in contact with any hard substance while damp, as it is certain to interrupt the evenness of the surface, and present in the print an unevenness that attracts attention.—I. B. WEBSTER.

250. Keep the paper in a damp, cool place, from twelve to twenty-four hours before silvering. This applies to every brand of albumen paper. It gives greater ease in silvering. The paper will take the silver better, and will also lessen the tendency to blisters to which the "Brilliant" papers are especially liable. Carefully examine the first sheet you silver each day, as it begins to get surface dry. If it looks as though the surface was greasy, reduce the strength of your silver solution. Dry as quickly as possible. Fume with ammonia until the paper prints a rich purple. Ten minutes will probably be sufficient. Be sure that, when the paper is once dry after silvering, it does not get damp again until it goes into the washing. In damp weather see that the fuming-box is dry. If damp, light a lamp, and leave it burning in the box for a quarter or half an hour before putting in the paper.—H. C. BRIDLE.

the season of the year and the salting of the paper. From twenty seconds upward is right.

251. After the sheets are thus silvered or sensitized, they are hung in a closet or drying-box, by means of clothes-clips at the corners, to be thoroughly dried. After this they are fastened to skeleton frames made of wood the size of the sheets, with a spring at each corner, and placed in a fuming-box to be fumed.

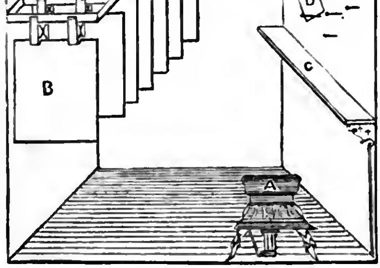
FIG. 61.



252. The operation of fuming is for the purpose of increasing the sensitiveness of the paper, and also the intensity of the prints. It continued according to the density of the negative, varying with circumstances. It is a good plan to hang the sheet with the end upward which leaves the solution last. Thus a more even silvering is secured. If the surface of the paper is horny and hard, "tear drops" will occur. Some prefer the use of blotting-pads for drying the paper If they are used, see to it that they are chemically pure.

251. This is my drying-room. A is the gas-stove by which the room is heated; B is the paper as fastened to the clips for drying; C is a shelf on which the silver bath-bottles, as well as the collodio-chloride bottles, are placed; D, D, D are plates, each hung upon two nails.—C. W. HEARN, *in the Practical Printer*.

FIG. 62.



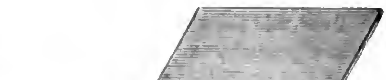
252. I will venture to describe my fuming-box —a little piece of apparatus which I devised several years ago, and is so much of a convenience, it seems to me that others might also find it useful. It consists of a tight box made of match stuff and well put together, and a drawer. The box is fastened up against the wall in the printing-room, in an inverted position, so that the drawer is opened by sliding downwards, and, of course, shut by sliding up. The drawer is the principal thing in the contrivance. It is wide enough to accommodate a sheet of paper, and is some six or eight inches longer than the sheet—say thirty inches long by twenty inches wide and five inches deep. The *top* end of the drawer is omitted, instead of which two pieces of twine are stretched across, from which, by means of clips, the paper is suspended. The sides of the box extend down two feet below, and serve as guides for the drawer when let down to put in or take out

253. If the paper is not printed as rapidly as it is fumed, it may be cut into proper sizes and kept for use in a handy drawer reserved for that purpose only. It will change color if exposed to the light, and as a usual thing it will not keep in good condition from day to day. The negative is placed in a printing-frame of suitable size, the film inside. The albu-

the paper. A stop is fastened to the wall, upon which the drawer rests when so let down or opened. A spring made of common strap-iron is let into the left guide-piece, in such a position that when the drawer is closed it is held by the spring in its place; a slight pressure with the thumb of the left hand allows the drawer to open. A bottle of ammonia is placed on the lower end of the drawer, where it is always at hand for use as occasion requires; and a small glass tumbler, from which the fumes are given off, completes the arrangement. By this device the fumes of ammonia, which are lighter than air, are allowed to remain in the fuming-box when the paper is removed; and in all respects the machine is as convenient as possible.—W. H. SHERMAN.

The construction of the fuming-box is very simple. Take any common wooden box, large enough for the purpose, and make a door of suitable size for it, which, when shut, will totally exclude all light. Make a false bottom in this about six inches from the real one, and perforate it with holes of about the size an extra large gimlet would make. These holes should be exceedingly numerous, and at the centre of the board there should be, if anything, a smaller number of them, because the saucer containing the liquid ammonia is generally placed at the centre of the real bottom of the box.

Fig. 63.



The sheets could be suspended in this box by having a nipper nailed at each end of a stick of sufficient length, which is fastened at the top of the box, parallel to the bottom of the box. Several of these strips could be placed at about three inches apart, and thus quite a number of sheets could be fumed at once. Sometimes, during damp weather, the fuming of the paper is attended with unsatisfactory results, on account of the great moisture of the paper, which tends toward turning it yellow; but this is generally overcome by pouring a little chloride of lime on the bottom of the box. The time of fuming the paper depends upon the state of the nitrate bath, the quality of the negatives, the temperature of the weather, and the brightness of the light. Paper silvered on an acid bath needs much longer fuming than when silvered on an alkaline or neutral one; paper for intense negatives requires less fuming than for weak ones; during the summer, less fuming than during the winter; and on a dark day, less of fuming than on a bright day.—C. W. HEARN, *in the Practical Printer.*

253. To silver paper that will keep, make a solution of nitrate of silver, thirty to forty grains strong; add to this two grains of citric acid to each ounce. After the citric acid is

men surface of the paper is now laid upon the film, the shutter made fast by the springs, so as to bring paper and negative in close contact uniformly all over, and the exposure made to the light, so as to allow the rays to fall horizontally upon it.

254. The exposure of the paper to the light is governed by the various conditions of the light, the temperature, the nature of the negative, and by the paper used. To secure a good print, the paper should be floated long enough to produce a clear and even picture, without any mottled appearance in the background; it should also be a little bronzed in the deep shadows, and it should be fumed long enough, that, when printed, it will assume a rich purple tone. In many cases, half a minute will be found sufficient to float the paper upon the silver, and in some cases, where the negative is very dense, the print will be improved by omitting the fuming altogether. The exposure ended, the prints must now be gathered together for the after manipulations.

dissolved, add ammonia as long as a precipitate of citrate of silver is formed; then redissolve the precipitate by the addition of nitric acid. Care must be taken in adding the nitric acid to add just enough to quite redissolve the precipitate, leaving a very slight excess of nitric acid. Float the paper in the usual manner; and, after drying, store away between sheets of blotting-paper.—H. T. Anthony.

To preserve sensitized paper, dip sheets of blotting-paper in a saturated solution of bicarbonate of soda; hang up and dry. When your day's work of printing is over, lay your surplus sensitized paper between these sheets, in a large book; the paper will keep as pure in color as when first silvered, and will not turn if left so for a week. This simple method may prove a great economizer, especially when after silvering a good lot of paper the day suddenly grows dark, and the light slow and almost devoid of printing power.—J. L. Gihon.

We silver and fume our paper the night before it is to be used, and for several reasons; in warm weather the evening air is cooler and favors the keeping of the paper, and I find it much more comfortable working with plenty of fresh air than being boxed up with a gas or kerosene light. Then, again, you are very certain no white light reaches the paper until it comes through the negative, and I am fully convinced that daylight, small it may be in quantity, is one great cause of yellow paper; and I, too, find that paper prints much nicer several hours after fuming than just after. Second, instead of putting prints into acid water direct, put them into a bath of plain water first. They will redden much more evenly and are easier to handle.—Julius Hall.

In a few words, let me recall some of the points to be remembered in order to obtain success in printing. Keep the paper damp before silvering, so that it may take the silver uniformly and quickly, and also as a guard against one source of blisters. Always keep a sufficient quantity of solution, and never think of starting to silver without being certain of the condition of your bath both as to strength and alkalinity. If you would have your paper print rich, do not allow it to become too dry before printing. If you would have your prints resist the atmospheric influences as much as possible, do not be afraid to tone them well. If these requirements are carefully attended to, success will follow.—H. A. Webb.

255. A bath of tepid water is prepared in a dish or tank, into which the prints are quickly or entirely immersed, one after the other, and allowed to remain from three to five minutes, at the end of which the water is changed, and the operation repeated. The first two waters remove considerable free nitrate of silver, and should be saved in a cask, the silver precipitated by means of salt. Two or three more changes of water are now necessary before the prints are ready for the following treatment.

256. Another bath of tepid water is now provided, to each gallon of which about one ounce of acetic acid has been added, stirring thoroughly so as to secure the complete acidifying of the water throughout the vessel. Now completely immerse the prints one by one, and allow them to remain, say, ten minutes, keeping them continually in motion. The object of this operation is to render the next one—toning—easier by changing the color of the prints, so the effect of the toning can be more readily observed, and the toning itself is thus accelerated to a considerable degree. The acid-water being next poured off, the prints are again washed

255. When the print comes from the printing-frame, it contains several substances which must be removed. There are the violet subchloride, Ag_2Cl, the red or yellowish-red suboxide, Ag_2O, and the free nitrate, $AgNO_3$. The free nitrate being soluble, is removed by washing; after which the subchloride and unreduced chloride must be removed from the print, as they are capable of further reduction by the light. Who has not wished that the print might be taken from the frame just at the right moment, and so preserved? But that which constitutes its beauty of color at that point is the violet subchloride on a substratum of the red suboxide. If it is now placed in the fixing-bath, the subchloride is dissolved, and the suboxide left. But the *color* in this condition is not satisfactory. So a substance was sought for to supplement this suboxide, and compensate for the loss of the subchloride. The search was successful and the result admirable.—W. H. SHERMAN.

Silver prints must be thoroughly washed from the free nitrate of silver before toning. If this injunction is obeyed in each and every case, the prints after being finished will keep pure and white, and not turn the least yellow with age. In alum eliminating the above must be adhered to. Prints in my possession of my own and others, made in 1873, are as good to-day as the day they came from the alum solution, eight years ago.—JOHN R. CLEMONS.

256. In acidifying the prints, a little warm water facilitates the reddening of them very wonderfully. The plan I have adopted for keeping the toning-bath warm is similar to that for the silver bath; the same pan will answer for both. Unless there is a very large number of prints, it will only be necessary to fill the pan with warm water; but if necessary, the gas- or coal-oil stove can be used for this also. In this case, care must be taken to prevent the bath from becoming too warm, as the action will not only be uneven, but also flat and gray, with a tendency to measles. The fixing-bath may be made up of warm water, and all the operations are through, with far more satisfactory results; and, as regards comfort, I will leave it for those who have tried this and the ice-cold solution to judge.—H. A. WEBB.

in several changes of water, until the odor of the acid is entirely removed, when they are ready for toning.

257. Now sufficient scope is given for the exercise of judgment and taste. Do not hurry. More prints are spoiled by making the gold solution strong in order to tone rapidly, than in any other way. This caution should be observed, and the prints turned over and over, so each one may be carefully watched, and withdrawn from the solution as soon as it arrives at the proper color or tone. The prints are not acted upon just alike, some becoming toned much sooner than others, hence the necessity of "going slow."

258. Operators differ in their tastes as to the most desirable tone to secure One prefers a warm or chocolate tone, while the rich, black, vel-

257. A solution of chloride of gold. What can this do? Gold is what might be called an ascetic metal; it likes to live alone. In other words, it is easily reduced from its salts to the metallic state. So when this sheet of paper, covered all over with silver salts, is brought into a solution of chloride of gold, the silver, having a great attraction naturally for chlorine, and the gold parting willingly with its chlorine, it is no more than can be expected to find the chlorine leaving the gold and uniting with the silver, forming, of course, chloride of silver; the dark subchloride, when the silver has been reduced to the subchloride by the action of the light, and the white chloride when the silver is unaltered, and then the gold, having lost that which held it in solution, has nothing to do but come down as a precipitate of metallic gold, and so metallic gold is deposited upon the picture.—H. M. McIntire.

Placing the whole number of prints, to be toned by a given quantity of gold, in the solution at once insures more complete utilization and equalization of the toning agent through the entire number of prints. The large surface exposed to the action of the toning-bath at once prevents rapid reduction, and there being in the bath nothing but the prints to precipitate the gold, the toning takes place with deliberation and uniformity.—W. H. Sherman.

The toning should be done in a *quite weak* and *even light*, and at a little distance from the window. An idea of the quantity of light required may be had by bearing in mind that all you wish is to see *distinctly* and *clearly*, without any guessing. Take a couple of dozen prints, and let them lay in your bath solution, face up, but under the surface, and keep them in motion while in it; the action is as follows: At first the prints will not perceptibly change, but very gradually the high-lights and half-tints of the face will lose their red tint, and will commence to border on the rich purple, and then they will quite quickly arrive at that stage when they are to be removed to a bath of running water.—Charles W. Hearn.

258. After washing away the nitrate of silver from the print (for the reason that the nitrate would only cause a useless waste of gold), we place the print in the toning-bath. Now the chloride of silver cannot be toned by gold! Why? Because the chloride of silver will not take any of the chlorine away from the chloride of gold. But the subchloride will take a little; enough to change it from the subchloride, Ag_2Cl, to the chloride $AgCl$, that is, one atom of chlorine for every atom or molecule of the subchloride. This accounts for the bleaching which usually takes place—the violet subchloride being changed to the chloride, which is white. But, if the bath be acid with hydrochloric acid, the subchloride is quickly changed,

vety tone of an engraving is liked best by others. For the last, use this toning bath:

Water,	32 ounces.
Acetate of Soda,	60 grains.
Table Salt,	60 "
Chloride of Gold,	4 "
Nitrate of Uranium,	4 "

The gold and uranium, both having an acid reaction, must be neutralized with bicarbonate of soda separately before being added to the bath. Dissolve the salt and acetate of soda in the water; then dissolve the nitrate of uranium in one ounce of water and add bicarbonate of soda, until neutral. Add this to the first solution and then neutral gold solution sufficient to tone in about fifteen minutes. Where a warm, brown tone is desired, the uranium may be omitted. This bath should be made several hours before use. But a few prints should be toned at a time, and they should be kept agitated while in the solution, for, if they rise to the top and remain there for a minute or two, a red patch will be the result, and the picture spoiled. Air-bubbles between the prints will also cause red spots. To prevent these, lay your prints in one at a time.

259. It is believed that the toning-bath most in use, and the one with which all varieties of tones may be secured, is the one first given in section 258. But this is not the only way, a choice being given by some to

and then some of the suboxide gives way, and is converted into the chloride again. Hence the more hydrochloric acid the more bleaching. But the toning takes place upon suboxide of silver, which is being converted into the chloride by the chlorine of the chloride of gold, and the gold takes the place of the silver thus removed.—W. H. Sherman.

Toning-bath for purple or black tone: Water, one quart; gold, three grains; sal soda, saturated solution, a few drops. Print deep and tone to the color you wish. For a brown tone, take one quart of water, one or more grains of gold, and one drachm of acetate of soda; let stand one hour; then add enough bicarbonate of soda to make the bath slightly alkaline. When the lights begin to look a delicate lilac, the shadows still red, take out the print.—C. A. Zimmerman.

259. The sulphocyanide bath will give, with ease, any tones, from the rich brown color only just removed from the foxy tone of a fixed untoned picture to a fine purple or pure black with a tinge of pink in the half-tones. In passing from the former of these to the latter, the print assumes many very pleasing colors, any of which may be retained by stopping the further progress of the solution at that point, as the hypo. fixing-bath seems to have no perceptible reducing effect upon the image when toned with sulphocyanide.

All the photographic papers I have used have given me successful results with this bath, and I have had no repetition of the strange and perplexing failure with which my first attempts were greeted. The prints, if required for the very deepest tone the bath can give, must not

various neutralizing ingredients, among which are sulphocyanide of ammonium, tungstate of soda, and carbonate of soda mixed with the acetate. It is but fair that the advocates of these modifications should be heard, and they are given the opportunity in the notes hereto.

be at all over-printed; if, however, the paler tones are sought for, a very slight amount of over-printing may be given. This alone is, in dark weather, a great advantage, as so many more copies can be secured from each negative in the course of a day. I have produced twelve prints with one negative in about an hour in sunshine, at this late season of the year, all of them printed deeply enough for successful toning. This is a point worth consideration. The prints should be well washed before toning, that is, until all the free silver is removed. The toning-bath which has suited my purposes best has been made as follows:

Gold,	1 grain.
Sulphocyanide of Ammonium,	20 grains.
Water,	2 ounces.

I have noticed that more gold is used in this than in ordinary toning processes. The image is first reduced, on immersion, to a foxy tone, and then it becomes strengthened by degrees to a series of colors, rich, warm, and brilliant, ending in black. It seems to me that all of them are formed by the constant addition of gold to the print; it is, as it were, intensified with gold. This, of course, involves a considerable expenditure of the precious metal, about two grains or more per sheet being used; but if, as I think, this gold is precipitated in a manner which leaves the print free from sulphur, it seems to me that it goes to render the picture more permanent, and if this should be found so in practice, the extra expenditure of gold will not be so much objected to.

I find *heat* a great accelerator of the process, making the toning as rapid as any other method, with perhaps only one or two exceptions. The bath can be used over and over again, fresh gold being added as in the case of the acetate bath. A very strong solution of hypo may be used for fixing without any risk of spoiling or reducing the tone.—NELSON K. CHERRILL.

All difficulties can be avoided by the use of the tungstate of soda bath. As it is used almost immediately after mixing, the gold does not precipitate; and if there be not sufficient gold in the bath, more can be added during the process of toning without danger of mealiness. I should recommend those who are successful with the acetate bath by all means to continue its use, but to those who find disappointment in its working I say, "Give it up, and try tungstate." The tungstate bath is very similar to the carbonate, but, whereas I have found the latter produce mealy prints, I have never in a single instance found tungstate a failure. The following is the formula:

Tungstate of Soda,	20 grains.
Chloride of Gold,	1 grain.
Boiling Water,	6 or 8 ounces.

Use it as soon as it has cooled, and after the first batch of prints are toned pour it into a bottle and keep it as the stock solution, and it can always be used without being again warmed, merely adding sufficient gold for the day's toning a few minutes before required for use, and with each grain of gold a grain or two of tungstate of soda. This bath will become purple in color, but that does not signify, and it can (by following the above method)

260. The chloride of gold sold by the dealers is of such excellent and uniform quality, that it is hardly of advantage to the photographer to make it himself. The operation is rather an unpleasant one, but it is simple enough. It should always be done in the open air, in order to avoid the fumes, which are poison to the lungs. It is prepared by dissolving gold metal in aqua regia.

Nitric Acid, C. P.,	2 parts.
Hydrochloric Acid, C. P.,	3 "

To, say, five gold dollars, to be added one by one. A gentle heat should

be used over and over again indefinitely, and will answer well either for ordinary sensitized or for ready-sensitized paper.—CHARLES DURAND.

I have tried nearly all the toning-baths I have seen published, but with the same result—that is, refusing to tone satisfactorily a great number of prints. No addition of gold would restore them to their primary working order; but the following I have found effective and always the same. I have used it for two years with perfect success. I have toned with it as many as five hundred *cartes* at once, besides nearly half that amount of 9 x 7, and other sizes. It ended as it began, with the same uniform speed and quality of tone. It is also very quick. You can get any variety of tone from warm chocolate to black and white. Take

Gold,	1 grain.
Acetate of Soda,	24 grains.
Carbonate of Soda,	4 "
Water (warm),	8 ounces.

Let it stand for about two days before using. When it requires strengthening, to each grain of gold add twenty-four grains acetate of soda to the bath before using. If it requires a fresh supply before all the prints are toned, add more gold (neutralized). It will tone as long as there are prints to tone. It will tone more prints and better than any I have ever had. I mixed up a bath at the commencement of the year, and I used the same for twelve months, and after toning many thousands of prints it was as good as ever. The first supply of carbonate is sufficient.—WILLIAM FERGUSON.

260. I take two drachms of nitric acid and three drachms of hydrochloric acid; in that I can dissolve a five-dollar gold piece. That is pure enough; the copper is an advantage rather than a detriment. In this way you have one hundred and thirty-five grains of gold. Reduce that so as to have eight grains of gold to the ounce, or one grain to each drachm, and you will always know when you pour it out how much you have. That will give you about sixteen or seventeen fluid ounces to a five-dollar gold piece. That will keep. You may put in salt if you choose; I sometimes do that. This solution will go farther than any you buy. A few hours before you use it, neutralize it with bicarbonate of soda, borax, or any of the alkalies you have a fancy for, or according to the tone you desire. Bicarbonate of soda will give you a brown tone, and borax a black. Make it up a few hours before you want to use it, so that it will turn litmus-paper blue, and I do not believe you can prepare gold to make better tones. When you make this solution it is acid, but you can neutralize it with bicarbonate of soda down to the point where a drop of it will turn green, or you can make it perfectly neutral, and add a little aqua regia.—H. J. NEWTON.

be applied, and the resulting mass well washed and dried, twice. To every grain of gold used, add one drachm of water.

261. From the toning solution the prints are now removed to the fixing-bath.

Water,	32 ounces.
Hyposulphite of Soda,	5 "
Carbonate of Ammonia,	1 "

The prints should remain in the above solution for fifteen or twenty minutes, according to temperature, and constantly turned over singly to insure thorough fixing, after which they should be well washed, until every trace of hypo is removed.

261. On removing the prints from the toning-bath, wash them several times in pure water, then place them one by one, if possible, in a bath containing three or five grammes of pure muriatic acid to a litre of water: here let them float, moving them about for a few minutes, then wash them further for two or three minutes in pure water to remove the acid. On warm days the operation should last longer than on cold. The prints are then placed in the fixing-bath, and in those rare cases when the finished prints have a slightly yellowish tone after the removal of the acid, should be first put for a couple of seconds into a solution of five grammes of ammonia to a litre of water; then washed once, and placed in a hyposulphite of soda bath. In this way any alteration of tone is rendered impossible.—J. L. GIHON.

See that the hypo is not *acid.* It should be neutral, or even slightly alkaline. The hypo should be made up fresh every day, especially during summer. Drain the prints well from the hypo, and place in strong solution of salt for five minutes, moving them about all the time, and then put them in running water for three hours. It is better to make the hypo and salt solution two or three hours before using it, as both hypo and salt make the water several degrees colder. The neglect of this is one common cause of blisters.—H. C. BRIDLE.

There is a diversity of opinion among photographers about the strength of the fixing-bath, some using it much stronger than others do. I am inclined towards having a weak bath, and fixing a longer time than I would with a strong bath, as the action will be more gentle, and on the whole better results are obtained by so doing, and blistering and bleaching are, in a great measure, cured. It is very important that the hypo bath should be made up every time you require its use, as old hypo-baths are very injurious to the prints. Take a two-gallon bottle, and place in it about ten pounds of hypo crystals, fill up with water, shake well, and label this bottle, "Sat. Sol. Hyposulphite of Soda." It is now ready to use in making the bath as per formula given below. To make sure of this hypo solution becoming saturated, prepare it at least two days before you wish to use it. Just before using, shake the contents in the bottle for about two minutes. When you wish to make the bath, take of

Water,	8 ounces.
Sat. Sol. Hyposulphite of Soda,	1 ounce.
Sat. Sol. Bicarbonate of Soda,	¼ "

Larger quantities in same proportion. *Make this bath in a dish which is kept expressly for this purpose, and this alone.*—C. W. HEARN, *in the Practical Printer.*

262. One of the chief evils of the printer's life is the phenomenon known as "blistering" of the prints. Much speculation has ensued as to its cause, and it is generally conceded to be governed largely by the temperature of the solution and wash-waters used. If these are uniform in temperature, "blisters" are not apt to occur. Another method of preventing them is to remove the prints from the fixing-bath to a salt solution.

Water,	1 gallon.
Table Salt,	16 ounces.

Allow them to soak in this for say ten minutes previous to the final washing.

263. The great blemish upon the character of photographic prints is that they oftentimes "do all fade as a leaf." All sorts of efforts are made to prevent this, but the most effectual is that of carefully washing them in several changes of water. Where it can be had, running water is the best, for it is self-changing; but the same end is accomplished by changing the prints with the hands from one water to another, using a clothes-

262. To avoid blisters, have all your washings and solutions the same temperature as near as possible; remember, your solutions act more perfectly and energetically if warm; about ninety degrees is the best for the above use. I can make blisters all the time by changing the temperature of solutions, that is, from warm to cold, or cold to hot. If all your washings and solutions are of one temperature, you will never be troubled with blisters.—A. Hesler.

As an absolutely reliable remedy against the formation of blisters on albumen paper, lay the paper, with the prepared side, on a sheet of blotting-paper, and then wash the back of it with a very damp sponge. The sheet thus handled must dry in the air, as drying with heat will cause red spots, especially when pink paper is used.—Dr. J. Schnaus.

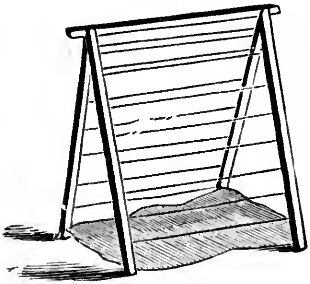
263. Several years since I published a simple and effectual method of cleaning the prints of hyposulphite of soda by employing the acetate or nitrate of lead; whether this process would leave the prints in a condition that would secure greater permanency was a question which time only could determine. I think the verdict, without a single exception, from those who have given it a trial, has been in its favor.

I have kept prints treated with the lead about six years, and some of them have been exposed for eight or ten months at a time to the direct action of sunlight, and yet show no perceptible change, while prints made at the same time and treated the same in all respects, except the washing, which was of the ordinary kind, have become yellow and faded. The process is as follows: Make a stock solution of the salts of lead, before mentioned, by dissolving two ounces in sixteen ounces of water. If nitrate of lead is used, the water had better be hot, as it dissolves very slowly in cold water. When the prints are fixed, wash them off in two or three changes of water, and place them in water containing two ounces of stock solution to every four quarts of water; they need remain in this lead-water only from five to ten minutes, and then they should again be washed in a few changes of water

wringer frequently between the operations. The last application of the water should remove all spots and specks from the surface of the pictures previous to their being mounted upon the cards intended for them. Allowing the prints to remain in "lead-water" a few moments is highly recommended.

264. After the final and thorough washing of the prints, they must be taken from the water, and unless, as some prefer, they are mounted upon the cards wet, they are then dried. One way is to hang them back to back upon a rack provided with cords, as shown in Fig. 64. If this method is practised, the cords should be frequently changed, lest, becoming stained, they injure the prints. The best method is to place the wet prints between chemically pure white blotting-pads, and there allow them to remain until dry. These blotting-pads, too, must be occasionally renewed. The "Treasury" blotter is the purest and best.

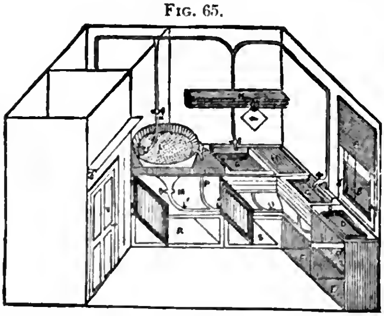
FIG. 64.



and the work is completed, and, by applying the most delicate tests, no trace of hypo will be found. When the lead solution is put into the water to receive the prints, there will be produced a trace of carbonate of lead, which will give the water a milky appearance. If the prints are put into it in this condition, the albumen surface will be injured by the carbonate adhering to it. The carbonate should therefore be dissolved before the prints are put into it, which is done by adding a little acetic acid, just sufficient to make the water clear.—H. J. NEWTON.

The principal use of this room is to sensitize the paper after it is albumenized, or, in the case of the plain paper, after it is salted, and then later in the day, when the sensitizing is through with, to tone and fix as well as to wash the prints in, all of which things can be done without at all interfering with each other. A is a dark curtain, which in the figure is partly raised, but during the silvering and toning process it is brought down to A′, and the *white* bleached cloth screen, B (which is shaded in the figure so as to show it more distinctly), covers the rest of the glass, and thus in the toning a soft and diffused light is given to that part of the room (the shelf, C,) where the toning is done; D is the silvering-dish, and D′ is the place where this silvering-dish is kept when not in use; E is where the kettle of potash is kept for the purpose of cleaning old plates; F is where the nitric acid tray is kept; G G are two sinks; H is a shelf on which the toning-bottles may be

FIG. 65.



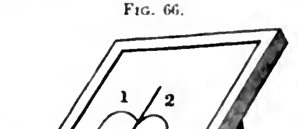
265. The same general rules adapted to printing portraits are also applicable to landscape printing, except that in the latter case clouds are sometimes "printed in" or worked upon the negative. Upon the subject of stereoscopic printing, however, a few notes will not be out of place, both as to the preparation of the negative for printing and for printing the same. Some "Centennial" experience will now come in well, but another shall tell of it.

kept; K is a rack with three overlapping pieces of wood, to which there are a number of spring clips attached, which hold the pictures while draining as they are removed from the water; L is a washing-tank which has a perforated false bottom, through which the water passes into the lower part, and thence into the waste-pipe L′. The stop-cock, M, is adjusted after the tank becomes three-quarters filled, so that it will permit the water to flow out as fast as it enters through the pipe, N; P P is an overflow pipe which conducts the water, when it reaches that place, into the waste-pipe, L′; R is the place where the hypo-dish is kept; S is the place where the two-gallon hypo-bottle is placed. This bottle is always kept full of a *saturated* solution of hyposulphite of soda. V is the door that leads into the drying-room.—C. W. HEARN, *in the Practical Printer.*

In answer to the question in the *Philadelphia Photographer*, What is the best way to wash prints when the water supply is small? My plan is to use Newton's acetate of lead bath, and having used it over a year, I can say it is a great saving of time and of water, besides the prints have a greater gloss than with the old method of long washing; and as to their keeping qualities, so far I think they have done well. The prints will last in direct sunlight longer than those washed by the old method.—W. H. KIBBE.

265. No eyes, however good their capacities for seeing, can at a glance gauge the separate sides of a stereo. It was obviously necessary to place guide marks upon the negatives. These had to be most carefully adjusted, otherwise the effect of relief would be marred, and the complaint would come from the office that prints from negative number —— were not stereoscopic when looked at through an instrument. The method of placing those register lines was for awhile a serious difficulty. A number of different plans were adopted from time to time. Ours was to make use of an ordinary retouching-stand. Upon the ground-glass inclosed by it draw a few lines as shown by the diagram Place one side of the stereo. negative on the ground-glass, over the indicated *shape*, and adjust it to suit the requirements of the subject. You will see that there is a perpendicular line. Note with the utmost exactness where that mark intersects the first half of your negative. *Then* slide your plate across the frame, and make the same perpendicular pass through exactly the same points on the other side. The establishment of a *base* line is the first item to be attended to. Make use of any sharp instrument, and with it scratch a line across the bottom of your negative, being careful to make the line pass through the same points that are indicated on each side. After having arranged your negative over the *shape*, paste a piece or rather a strip of yellow paper along the edge that is marked 2. After moving the negative across the retouching-

FIG. 66.



Both in printing and toning stereoscopic pictures see that both ends are of the same depth and color. It looks exceedingly bad to see one end lighter than the other, or one end a deeper tone than the other. If the ends of the negative vary in strength—and this is often the case—then a thickness or two of tissue-paper will be found enough to correct the evil. It hardly pays to print clouds in pictures so small as the stereoscopic size, and yet they add much to the charm of the prints if they can be introduced. If they are, they should be natural and not artificial. The nicest attention to details is required in stereoscopic work.

stand and placing it as I have directed, that is, with the perpendicular pencilled line of the ground-glass showing through *exactly* the same points of the subject, paste another strip of paper along edge 1. You now have the negative with a line at the bottom across its entire length, and with a guide at each side. Prints made from it so prepared will plainly show a black base-line and white uprights at each end of the strip.—John L. Gihon.

I send you a little dodge in the printing line, which I find useful in making prints from stereoscopic negatives, and by which cutting and transposing either the prints or the negatives are saved. In the first place, I have a bottom line on my negative, which can be made by pasting a narrow strip of paper, or drawing a clear line with a sharp knife on the base of the negative, and which serves as a guide for cutting away the edge of the print. Next cut your paper in strips, suiting the *width* of your negative, and just *twice* its length. Have a piece of smooth, thin, opaque paper just the exact length of the negative, draw a vertical line on this in the centre; lay your paper, albumenized side out, on this mask, making the ends to meet at the line; now print first on one side and then on the other, taking care to have the base-lines correspond; and when the print is made, cut the paper in the centre, and it is already matched, transposed, and ready to have the corners trimmed either round or square, and mounted.—E. P. Libby.

My method of printing clouds is as follows: After I have placed the sensitized paper in contact with the negative, I take some red and black ink, and mix to a fairly non-actinic color, thickening with a little gum to the consistency of cream, and then smear with a thin piece of stick (say the point of a penholder), lightly, in front of the plate with varying, irregular lines between, say, a high hill and a castle or church; in fact, anywhere where the print would look all one mass of light. After this application I very lightly brush these smears with a very fine, broad camel's-hair brush (such as grainers use) various ways, but more especially obliquely in both directions, and the clouds appear in the one printing equal or even superior to prints which require two separate printings, besides saving considerable time and trouble; and this alone, to amateurs, I presume, must be a matter of importance. Of course the lines must not be parallel or straight, but should take the irregular form of clouds, and then be shaded nicely off with the brush. Practice makes perfect, and a very little practice in this case is all that is required.—J. H. Storr.

LESSON N.

PRINTING ON PLAIN PAPER.

266. BEFORE albumenized paper came into use, all paper photographs were printed upon what is yet known as "plain" or "salted" paper. It is still used for enlargements, copies, and for such pictures as are to be afterwards finished by means of color, crayon, or India-ink, but is gradually being supplanted by Mr. Willis' platinum process. Brief instructions as to how such prints may be produced, will follow. Should you prefer not to salt your own paper, it can be purchased of excellent quality of the dealers, already salted, and thus some trouble is avoided.

267. The method here given is known as the ammonio-nitrate process, and is the best for the purpose. The salting solution consists of

Water, ...	4 quarts.
Chloride of Ammonium, ...	256 grains.
White Gelatin, ...	100 "

Dissolve the gelatin in the water by the aid of heat, then stir in the chloride of ammonium until dissolved; filter for use when cold. The sheets of paper should be entirely immersed in the solution, air-bubbles being avoided, allowed to remain two minutes, and then hung up to dry in a room free from dust. Do *not* use the same clips employed for the silvered paper.

268. Silver solution for plain paper.

Pure Rain or Distilled Water, ...	9 ounces.
Nitrate of Silver, ...	1 ounce.

Dissolve the silver in the water, and separate three ounces of the solution from the rest, to which add liquor ammonia until the oxide of silver formed is redissolved, and the solution is again clear; then add it to the remaining six ounces of solution. Oxide of silver will again be formed, which can be allowed to settle to the bottom of the bottle and remain there until the solution is all used. This can be applied to the paper with

a swab of cotton, wool, or canton-flannel. A portion of the silver solution should be filtered every time it is used, otherwise there will be a marbled appearance on the paper, caused by the scum which collects upon the surface of the solution. Care should also be taken to apply the solution evenly and lightly, otherwise the surface of the paper will be roughened.

269. After silvering the plain paper it is dried by heat, and then fumed, say, ten minutes, when it is ready for printing. Great care should be exercised in handling it, as it is easily soiled and spoiled. As a usual thing, a weaker toning solution is required than for albumenized paper. A good plan is to tone the prints on this paper after the others are done.

269. To those preferring to salt their own paper, the following hints may be useful: Always remember the *quality* of salt has much to do with the tint of the print; the *weight* of the salt affects the picture in the same manner. If the bath for salting is under strength, the print will show it by a weak, bluish look, and an entire absence of the rich purplish contrasts in the face. Again, oversalting will make the printing slow and tedious, and the blacks will be feeble and of a reddish tint; measly spots are apt to show, and the whole print will appear flat and unsatisfactory. It is well to immerse some kinds of paper; but if the plain Saxe paper is used, it should be only *floated*, not immersed. Lay the paper perfectly flat, and lift off again with the same care as in silvering. Every printer has his own idea about the amount of gelatin needed in connection with the salting; however, this is a good medium rule; for ordinary Saxe paper, about one box of gelatin to four gallons of salting solution, in warm weather; in the winter this quantity can be nearly doubled. If the salting is done with chloride of ammonium alone, the prints will be rather brownish, and the paper will not keep so well, nor print so rapidly, as when the ammonium is used in equal proportion with the common salt. The following are the proper proportions:

Chloride of Ammonium, ...	1½ grains.
Common Salt, ...	1½ "
Water, ...	1 ounce.

Gelatin, thirty grains to the quart, in summer; in winter, use from fiftv to sixty grains to the quart.—John L. Gihon.

LESSON O.

GENERAL REMARKS ON PRINTING.

270. The instructions given on printing, thus far, are by no means to be considered exhaustive. An effort has been made to inform you only as to the best known methods for producing ordinary photographic pictures, and to try to induce you to exercise care, cleanliness, taste, neatness, and economy in producing them. Should you desire to go further, Mr. Charles W. Hearn, in his admirable work, the *Practical Printer*, which should be in the hands of every printer, will lead you into all the realms of "fancy," "glace," and "porcelain" printing, and give far more elaborate instructions throughout than it is the province of this rudimentary work to undertake.

271. Printing surfaces, too, are as various as the processes. Photographic prints can be made upon almost any substance sufficiently plane to enable one to secure contact with a negative, and non-absorbent, and smooth enough to receive the proper materials for printing thereon. Prints are made upon fabrics of all kinds, metals, mica, wood, porcelain, stone, leather, the human skin, enamel, animal pelts, and what not, from negatives, and by many other methods on various substances.

272. But printing is not confined to the use of salts of silver, as, besides the aniline, the platinum, and the carbon processes well known for years, there are various so-called photo-mechanical methods of printing photographic pictures. The most ingenious of these bears the name of its inventor, Mr. Walter B. Woodbury. Almost all the others are founded upon one principle. With them the means of producing the printing surfaces are varied, but the printing proper is much the same as lithographic printing, and is done in the same sort of a press. None of them displace silver printing for every-day photographic custom-work, and so they will not be treated of further here, but will be given more attention in a lesson further on, with some hints as to the manner of working them.

LESSON P.

PRINTING ON VARIOUS SURFACES.

273. As stated in Lesson O, photographic prints may be made upon all sorts of surfaces. A very pretty application is to decorate the corners of handkerchiefs with the portrait of the owner, or giver, be it linen or silk. For engravers' use, photographs on wood are in demand, as they give better results than the work of the draughtsman; at least, they make the work of the engraver easier.

273. To Print on Linen.—Make a salting solution of two grains of chloride of ammonium to every ounce of water. Make a sizing solution of

Water,	1 ounce.
White Glue,	2 grains.

Soak the glue in hot water until it is dissolved, and then apply the solution to the part to be printed upon. When dry, apply the silver solution with a tuft of cotton, shielding the unsized portions of the linen. Fume when dry, and print in the usual way, or in the handkerchief printing-frame. Tone in your usual toning solutition, fix, and wash well, using *hot* water for the final washing.—George W. Wallace.

Printing on Silk.—Pour 20 ounces of boiling water on 100 grains of chloride of ammonium and 60 grains of Iceland moss. When nearly cold, filter, and immerse the silk in it for fifteen minutes. To *sensitize*, *immerse* the silk in a twenty-grain solution of nitrate of silver for sixteen minutes. Let the nitrate bath be rather acid. When dry, prepare for printing by attaching the silk to a piece of card-board a little smaller than itself, by turning the edges over and fastening with small bits of gummed paper; slightly over-print. Wash in two or three changes of water, and tone in a gold bath, thus:

Water,	20 ounces.
Acetate of Soda,	2 drachms.
Chloride of Gold,	4 grains.
Common Whiting,	a few grains.

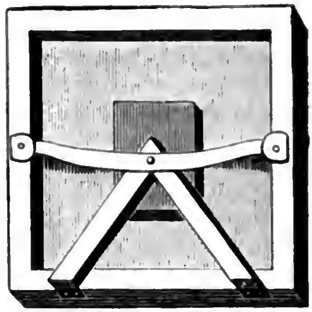
Filter, and keep for twenty-four hours before using. Let the prints be toned slightly bluer than required to be when finished. Rinse them in water, and fix in a solution of hypo, four ounces to the pint of water. Twenty minutes is ample time for fixing. Wash well.—T. C. Phillips.

Photographing on Wood.—I use, first, salt albumen: beat the white of one egg with an equal amount of water, making about two ounces; add ten grains of chloride of ammonium, and filter; moisten the block with water; whiten it with Chinese white, rubbed up with water, or the enamel from a card will do; brush it smoothly as it dries; when dry flow on the

274. A once very popular style of portraits was printed on porcelain glass. They have fallen into disuse somewhat, because of their readiness to fade, though they should not do so if properly washed. The notes are referred to for the means of producing them. Photographs printed

salted albumen; spread it over the block with a piece of glass, drain, and dry; make a little wall around the block with a roll of wax. Now pour on the silver solution, and spread with a glass (silver, the same as for paper), drain, dry, and fume it; after which it will be ready for printing. Print the same as a porcelain; tone with weak gold; fix with hypo. I use a home-made printing-frame; I find it very handy for printing porcelains and many other things. I take an ordinary 8x10 printing-frame, and fasten a glass at the bottom. I fasten the glass in the printing-frame with two little wedges of wood at the end of the glass. They hold it very firm, and are easily taken out when you wish to use the frame for other kinds of printing. On the top I fix a triangular-shaped piece of wood with hinges, making the point come at the middle of the frame, screwing a strip of brass across the joint for a spring. I fasten the block underneath with wax, so it can be taken off. When you wish to print a block of wood, stick the negative on the plain glass with wax at the corners. For printing on wood it is often necessary to use a reversed negative, which I get by first making a ferrotype, and whiten it with mercury, then make a negative from it.—Charles Homan.

Fig. 67.



For wood-block printing, the sensitizing solution is prepared in the following proportions:

Ether,	1 ounce.
Alcohol,	1 "
Gun-Cotton,	8 grains.

When dissolved, take thirty grains of nitrate of silver and dissolve in as small a quantity of water as possible, then mix with the collodion just prepared. Allow it to stand in the dark for two or three days, and it is ready for use. It is better, always, to keep it in a dark place. The sensitive collodion being now prepared, pour it over the block the same as when coating a glass plate. After draining, dry gently before a fire, taking care not to use too much heat, as it is apt to destroy the texture of the wood and make it brittle. It is now ready to be printed on in the usual way. The print is produced rather quicker than an ordinary paper one, and can be examined with very little more trouble. If not dark enough when looked at, it can be exposed again, as by a little care in setting the block to the lines already marked on the negative there need be no fear of doubling the impression. Print very little darker than what is required, then dissolve off the film with ether and alcohol mixed in equal proportions. Gentle rubbing with a sponge assists greatly in removing the film, and be particular that all is removed, as if any be left it interferes considerably with the engraving. After this is done, fix with hyposulphite of soda for a few minutes, allowing only the surface of the block to touch the solution; then wash with a gentle stream of water, taking care to keep the back as dry as possible, as the wood is very apt to be destroyed if allowed to get soaked with water. Set aside to dry, and it is ready for the engraver to manipulate on.

upon porcelain glass, with a ground surface and finely colored, are very beautiful; though they, too, have been largely superseded by the fine results now obtainable without any help from color.

A few words now in regard to the taking of the negative. The process, of course, is the same as usual; the only difference is that the image must be the reverse way from ordinary work, which can easily be accomplished by exposing the back of the plate to the light and taking the image through the glass. When the plate is taken from the bath, drain thoroughly, and wipe the back perfectly dry with a piece of blotting-paper, being careful to leave no streaks, as they would be sure to show on the negative. Then put it into the dark-slide with the sensitive side towards the spring. At the top and bottom of the plate, on the film side, put a strip of two- or three-ply of blotting-paper, and then put a glass plate on the top of that; by this means you will prevent the spring of the slide from coming in contact with, and damaging, the film. After focussing, you must measure the thickness of the glass on which you intend taking the negative, and move back the lens as much, otherwise your image will not be in focus. By this means you will find no difficulty in getting reversed negatives.—ALEXANDER NICOL.

274. COLLODION FOR PORCELAIN PICTURES.—

1.—Negative Gun-Cotton,	60 grains.
Alcohol,	2 ounces.
Ether,	3 "

Put three ounces of pure alcohol in a small bottle, add to this 120 grains of nitrate of silver, very finely powdered. Set the bottle in water, and heat to boiling-point; keep it there *until all the silver is dissolved in the alcohol.* As soon as this is done, pour the silver solution, still hot, into the collodion, stirring up all the time to secure a perfect solution.

2.—Chloride of Strontium,	32 grains.
Citric Acid,	24 "

Reduce to a fine powder, and dissolve in four ounces alcohol; add

Ether,	4 ounces.
Gun-Cotton,	60 grains.

These two collodions will keep for any length of time, and when mixed in equal proportions will produce brilliant prints.—GEORGE H. FENNEMORE.

TO PRINT ON PORCELAIN.—Coat the porcelain with albumen from *fresh* eggs and water, equal quantities. After the plate has dried (without heat), warm it and let it cool again. Coat with the collodion (mixture of Nos. 1 and 2), in a moderately dark room, and dry the plate perfectly over a spirit-lamp. Lay the negative on the prepared porcelain, being sure to have it in the right place; protect the back of the porcelain with yellow paper, and put plenty of patent clothes-clips all around the edge to secure a good contact.

TONING PORCELAIN PRINTS.—Wash first in plain water, next in water containing a very little salt. Tone in

Water,	8 ounces.
Gold Solution (1 grain per ounce strong),	1 drachm.

After toning and washing, fix in

Hyposulphite of Soda,	1 ounce.
Water,	10 or 12 ounces.

G. SCHREIBER.

LESSON Q.

PRINTING PERPLEXITIES.

275. A FEW further "indications" as to the imperfections in prints, may not be out of place. The same faults were found, the same tribulations troubled the printer, in the early days of silver printing as now—as then. With care they can be generally avoided, but as we are not always careful, it will be of service to know the *cause* of any evil when it presents itself, and thus have a suggestion, too, as to the means of working out a cure.

276. One of the first perplexities which the printer novice meets, is the discoloration of his nitrate bath. One of the greatest causes of this annoyance is leaving the solution uncovered, exposed to dust and air, when not in use. Constant use also causes discoloration, and careless filtration

275. Be sure that the back of the negative is clean, and that the contact is perfect before the negative is exposed to the light. When you wish to examine the print, go slow and sure. Do not allow the negative or paper to slip from their position, as that is sure to spoil the print, and result sometimes in spoiling the negative. Over- or under-printing is equally bad. The first results in an unpleasant heaviness, while the latter loses individuality. Watch the bleaching effects of the toning-bath and fixing solution, and print to it. Anticipate the tone before you reach it, and print to conform to it.—I. B. WEBSTER.

276. The various methods in practice for decolorizing the silver bath for printing are the addition of kaolin; carbonate of soda producing carbonate of silver, or carbonate of silver direct; chloride of sodium, or chloride of silver; citrate of soda, and other like salts; Mr. England's late method of boiling the bath; and, lastly, the addition of a very dilute solution of permanganate of potash. Having given a good trial to most of these, I can speak of their various capabilities, and which, after a long practice, I greatly prefer for decolorizing the printing bath.

There is nothing that answers more perfectly than the old-fashioned stirring up with kaolin, but it is a very dirty process. It must always be done at the close of work, as it takes a long time to settle; a much larger quantity of solution must be always kept than is required; and although, by treating it, when done with, with nitric acid, a good quantity of silver may be recovered, still I believe it entails a great loss. Of the various alkaline salts which, added to the bath, produce salts of silver which unite with the coloring matter, and are either precipitated together or are filtered out in combination with each other, the carbonate and citrate of soda answer the best, but filtering is necessary, as they are so long settling.

will do the same. Knowing the causes, it is easier to prevent them; but when the trouble occurs, the bath may be rectified by the addition of kaolin, or some neutralizing ingredient—say permanganate of potash.

277. A mottled effect sometimes appears on the paper after coming from the printing-frame. This is known as "measles," and is generally caused by the paper being insufficiently silvered, but sometimes arises from an inferior quality of paper, which imbibes the silver unevenly. If it comes from a lack of silver, the paper will print better on the end of the sheet which is lowest when hung up to dry, because the silver running down concentrates in drying, thereby leaving a larger quantity of

A plan I tried, to avoid the loss of precipitating the silver from the bath, and so reducing its strength and the consequent loss for the time of the silver, was to wash one batch of prints in as small a quantity of rain-water for their first wash as I could, pour off into a jug or large measure-glass, and precipitate the silver roughly with carbonate or citrate of soda; without waiting for it entirely to settle, I poured the liquid into the residue tub, and then added the precipitate to the printing-bath. By this means I avoided throwing nitrate of silver out of use for some time.

Mr. England's method of heating the bath is founded on the same principle as sunning the negative bath, heat in the former roughly doing what the actinic rays have more delicately to do for the latter, in both cases the solution being made alkaline. The silver is partially reduced and precipitated in combination with the organic matters. This process is troublesome, and takes time for its accomplishment. By far the best of all the methods I have put in practice is that of the addition of a dilute solution of permanganate of potash; it can be done on the instant; in fact, is best added to the measure just before pouring into the floating-dish. I have never found filtering at all necessary. One great advantage it particularly possesses is, that you can decolorize in the middle of work without stopping. It is well known that, after floating a dozen sheets in a bath in the heat of summer, the bath begins, with some papers, to darken, and will injure the purity of the whites of vignettes, and it is usual with printers to reserve the first sheets off the bath especially for them; but if you should have a large run of vignettes, or get used up with your reserved sheets, you must give up, or get out a fresh bath; but with the permanganate you have only to add a little more to the dish without removing, stir up, and you are as clean as at first starting. About a drachm a day of a ten-grain solution is quite enough for a gallon of bath. There is only one thing I have found necessary to take care of, which is, not to add more than is just necessary to take out the color. I fancy that more than this somewhat reduces the vigor of the proofs. I only hope that those who have not done so will give it a fair trial, and they will soon give up every other method for it.—F. G. Eliot.

277. For the information of those who do not understand the chemistry of nitrate of silver and alkaline salts, I will try to explain the action of neutralizing agents. If ammonia or carbonate of soda be used to neutralize a bath, a reaction takes place,—a simple one with ammonia,—in which the nitric acid combines with the ammonia to form nitrate of ammonium, which remains in solution in the bath as a neutral salt. With carbonate of soda a double reaction, in which the base, the metal sodium oxide, is converted into nitrate of soda, and

free nitrate in that part of the sheet. If the paper itself is in fault, the mottled appearance will be evenly distributed all over. The remedy is to float your paper longer, if it is under-silvered, providing you are floating less than two minutes; if you are floating it that length of time or more, strengthen your solution about ten grains to the ounce, and try it again. When the paper itself is in fault, it is generally caused by the sizing; lay it in a damp place for some time, until the sizing gets softened; it will then absorb the silver solution better.

278. Red marbled lines, and a quantity of minute red specks after toning, but not visible before, are seen on the prints. There is no remedy for such paper. It is badly albumenized; the lines are formed by the albumen running unevenly down to the edges, and the red specks by dust settling upon the surface when drying. Minute air-bubbles in the albumen are also a frequent cause of red specks. All paper causing these should be rejected at once and sent back to the dealer.

279. The paper has a marbled appearance after silvering. This is caused by dust and scum floating upon the surface of the silver solution,

remains in the bath in solution as a neutral nitrate, and the carbonic acid combines with an equivalent of silver oxide to form carbonate of silver, which falls to the bottom as a white precipitate. The nitrates of ammonium and sodium in the bath can only be regarded as *idle matter*, better out of the way.—F. M. Spencer.

I used to make a great mistake in testing the printing-bath by using blue litmus-paper, supposing that if it did not turn red that it was alkaline; but I was continually tormented with what is termed measles, until, through the kindness of Mr. Hearn, I was advised to use red litmus-paper, and when that turns *slightly* blue I am sure of an alkaline bath. It should be tested every morning after it is filtered, before using, and if not alkaline add ammonia. Never add muriatic acid just before using; if too weak, add a few crystals of silver and a little camphor, and go ahead with your silvering. Keep camphor in stock prepared as follows:

Gum Camphor,	1 ounce.
Alcohol,	6 ounces.

C. M. French.

278. Sometimes there is a want of affinity between the sensitizing solution and the albumenized paper. The cause is a simple one, easily rectified. The silver solution is too strong for the paper, and thus causes red globules and zigzag or marbled lines. The difficulty occurs only when the paper is too heavily albumenized. Papers coated with weak albumen, sensitize evenly with silver solutions on any strength, simply because the pores are left open to exercise capillary suction. It is a curious fact that heavily albumenized papers require the weakest silver bath.—J. L. Gihon.

279. To take albumen out of silver solution for printing, dissolve one ounce of gum camphor in six ounces of ninety-five per cent. alcohol; of this, add to any positive silver bath (that has albumen in it, or becomes black or foul) a few drops at a time, and shake it well;

and by the solution becoming contaminated with albumen. Always filter before use; and if the solution remains in the dish any length of time, draw a couple of strips of paper over it to remove the scum.

280. Red patches formed during toning. These are caused by the prints being allowed to rise above the surface of the solution, by two or more prints sticking together, and by air-bubbles forming between the prints. The remedy is to tone but a few at a time, and keep them moving in the solution.

281. Defective toning. When the prints are red after fixing, they have been insufficiently toned; when a cold blue, they have been excessively toned; when prints are toned to a blue, and get very red in the hypo, the gold bath is too strong, the gold attacking and toning the surface before it has time to penetrate through the print. The remedy for this is obvious.

if the bubbles do not break when the bottle is set down, add a little more until it ceases to froth or bubble, then filter at once. If the silver should turn after filtering, add a very few drops of permanganate of potash, which will clear it up at once. This last should only be added drop by drop in *quantum suf.*, else the albumen surface will be injured.—John R. Clemons.

For removing albumen from silver baths, to save alcohol, place your silver bath in an evaporating-dish and reduce it to about one-third or so, then pour it into a common glazed pie-dish, or, if not convenient, any ordinary flat dish will do. Let it be kept for that purpose. When the solution is cold, add about an equal quantity of alcohol, then light with a match; it should burn about five miuutes. Place the bath where the air will not affect the flame. When the flame expires, the solution will be entirely clear of red or dark matter, and the albumen will be found coagulated at the bottom of the dish, and can be readily removed by filtration. By this process any albumen bath—no matter how dark or how filthy—can be quickly and effectually cleansed.—John R. Clemons.

281. My treatment of the gold I find to be well adapted to the printing process. My toning-bath, stock solution, is formed of

Chloride of Gold,	30 grains.
Acetate of Sodium,	30 "
Water,	30 ounces.

With my prints, I find no difficulty in using it immediately, but prefer not to use it until a few hours after making. When required for use, I take water sufficient to contain the prints made from four sheets of paper, and to this I add one ounce of the stock solution. This is sufficient to tone four sheets. It will be observed that the stock-solution contains one grain of gold for each ounce of water. It follows then that one grain of chloride of gold will tone four sheets of paper. This may be considered too much paper for the amount of gold, seeing that the usual direction prescribes a grain of gold for each sheet. Dr. Vogel, referring to this subject (see *Handbook*, p. 139), says, "We have to calculate 0.06 gramme equal to one grain of gold for every sheet of paper," whereas my regular practice is to tone the

282. The finished prints have a dark, mottled appearance when viewed by transmitted light. This is caused by imperfect fixing. Either the hypo solution is too weak, or the prints were not allowed to remain in it long enough. They should be left in the solution until you can see nothing but the fibre of the paper in the white parts of the print when held up to the light. If this is not done, they are apt to fade or turn yellow in a short time.

283. Yellowness of the prints when finished. Several causes will produce this, such as leaving the prints in the hypo longer than necessary to

number of sheets stated; and I have frequently, for experiment, put as many as *seven* sheets at once into the bath, with only one grain of gold, and have succeeded in toning the whole quantity well and thoroughly.—W. H. SHERMAN.

Care should be taken not to use too weak a gold solution. I like this:

A.—Chloride of Gold,	1 grain.
Water,	1 litre.
B.—Acetate of Soda,	15 grains.
Water,	500 "

Pour the solution A into the solution B; to this four drops of a saturated solution of cupric sulphate should be added, and the whole allowed to stand for a few days. The pictures should be toned only until the half-tones appear somewhat bluish. The proper tone may be judged by watching the progress of the toning of the face specially. The operator will perhaps fear that his results are too red, but it will be found that the pictures are properly toned and the whites beautifully colored after fixing. A weak fixing-bath, say one to ten, is recommended.—HERR RICHTER.

The process I follow is: Pour out a sufficiency of your old bath, and add your gold about fifteen minutes before toning, stirring well; then, *just before* toning, add enough saturated solution of sal-soda to render the whole *slippery to the touch.* Do not try to make it just alkaline, and test with litmus; for it will not work. It will only bleach, and leave the half-tones dirty and bricky. So do not be afraid, but pour in till it is alkaline to the touch. The amount may be from one-half ounce to one ounce of the saturated solution to the gallon of bath. This will tone brown, blue, or black; but if the latter is desired, of course an addition of chloride of lime helps the matter, but also sooner spoils the bath.—M. L. DAGGETT.

282. To secure permanent prints, wash them in *warm water*, but do not boil them. All sorts of learned reasons have been given concerning the formation of insoluble compounds and their destructive nature and effects; but long years of experience have taught me that the best preventive against *fading* is warm-water washing, either in winter or summer. Since I adopted this plan, many years ago, I have never seen one of my prints fade; while those of others alongside have exhibited symptoms of yellow fever, increasing in intensity until they became defunct or melancholy evidences of carelessness. Some may say—"But warm-water washing injures the tone." I say—"Not necessarily so." But, if it does, be bold and honest enough to sacrifice tone for permanency.—J. WERGE.

283. Nitroprusside of soda is one of the most delicate tests for alkaline sulphides known. This salt requires about two and a half parts of cold water for solution. Its solution is de-

clear them; acidity of the fixing-bath (this can be avoided by using carbonate of ammonia with the hypo, or where this cannot be obtained, a little bicarbonate of soda or a drop or two of ammonia, will neutralize all acidity); the hypo-bath used until decomposition takes place. The latter is a fruitful cause of yellow prints. Never use it more than twice, and it is much better to make it fresh every time. Extreme warm and sultry weather will sometimes turn some samples of paper yellow beyond redemption. The same effect is produced by keeping paper some days between the time of sensitizing and printing. Frequent tests should be made, if danger is suspected.

284. Yellow patches and stains. These are caused by careless manipulations, such as finger-marks upon the surface of the paper; washing the prints in imperfectly cleaned dishes, or in the tank that received the prints from the hypo the day before; hypo on the fingers while toning. If there is the least trace of silver in the tank when it receives the prints from the hypo, they will all be stained, and *vice versa*. If there is the least amount of hypo in the water while washing the silver out of the prints, they will be stained. To know the above causes is to know the

composed by the sun's rays. The crystals are rhombic and of a splendid ruby color, and give a most beautiful violet tint with soluble sulphides—such as hyposulphite of soda, etc. —John R. Clemons.

284. Now for the secret of pure whites, and the only way you can get them pure. Procure your half ounce of aniline blue, letter R, and dissolve it in sixteen ounces of water. When your fixing-bath is made up, add from thirty to forty drops of the blue to every forty ounces of fixing-bath. Fix your prints from twelve to fifteen minutes, and remove to a strong solution of salt and water. Let them remain five minntes, and then gradually dilute with fresh water, so that the change of temperature will not be so sudden, and you will never be troubled with blisters, and will always have *pure* whites. I have this from Mr. J. R. Clemons.—Frank Thomas.

The "aniline blue" process, as recommended by me, will be found very advantageous, giving to new prints delicate, pure whites, attainable by no other means, and restoring old or yellow prints to their original purity. Besides improving the general tone of every-day work, it is of immense advantage in copying old or yellow photographs, which give no contrast whatever. Immersion in the aniline solution restores the whites, and enables the photographer to get a negative with all the detail of the original. The manner of using is as follows: Dissolve one-half ounce of powdered aniline (known as "water-blue, letter R,") in sixteen ounces of water. This is the stock-solution. When you mix your fixing-bath, add from thirty to forty drops of the blue solution to every forty ounces of fixing solution. This will produce *pure whites*, and will also prevent blistering. If you want a blue tint, or moonlight effect, take the print from the hypo and immerse in a saturated solution of alum, and the blue is permanent. If the color is too deep for you, immerse the print in a saturated solution of borax, and you may lessen the tint as far as you please.—John R. Clemons.

remedy, which is to have a sufficient number of dishes, keep them perfectly clean, and particularly keep the hands clean.

285. Metallic spots. There is no remedy for these. They are caused principally by metallic substances being ground up accidentally with the rags in the manufacture of the paper, or other local causes.

286. Loss of albumen from the paper during silvering. Your solution is too weak, or perhaps too alkaline on account of an excess of free ammonia.

287. The prints refuse to tone. This is often the fault of the paper, or may be caused by keeping the prints too long, in warm weather, between the printing and the toning, or by traces of hyposulphite in your toning bath, carried there by your fingers or otherwise. Many or all of these defects may be caused, too, by cold weather and cold solutions.

288. Mealiness. A great many blame the paper itself for this defect, but one seldom finds any that, with careful manipulation, gives mealy prints. By adopting the following methods, however, one can produce them upon any paper: By printing from a very weak negative; by floating the paper upon a very weak solution of silver; too much gold in the

287. I believe amateurs generally find it a difficult matter to keep their sensitized paper white for a considerable length of time. When I commenced photography, I was for some time unable to keep my sensitized paper white. It became unfit for printing in about three weeks; but I am now able to keep it, without fuming or using any chemical preparation, for a much longer time. It is now over six months since I bought the last lot, and almost all of it is as white as when I first received it. I cut it first into sizes I use, viz., *carte*, quarter, half-plate, etc., and place them in an old cigar-box without a lid, but use, instead, two or three thicknesses of yellow tissue-paper as a cover. I then put the cigar-box into a dark cupboard, and when the sensitized paper becomes too dry I just wet the tissue-paper with clean water. This can, of course, be modified.—P. Hardwick.

If the room becomes chilled before morning, the first thing I do is to put a kettle or other vessel of water on the fire or over a gas-stove, and while changing my clothes, filtering the silver, and getting ready for work, the water will become quite hot. I pour this into the silvering-dish, and allow the dish to get hot, and when this is replaced by the silver bath it will raise the temperature to about what is needed, and will remain so long enough to silver what paper is required for a day's work in an ordinary gallery. Where it is required to silver paper for half a day or more, as in some galleries where I have worked, a very good plan I have found is to have a pan large enough for the silvering-dish to sit in, and a couple of pieces across the pan about one and a half or two inches from the bottom, for the silvering-dish to rest upon, and this filled with warm water, which can be kept at the proper temperature, say, about sixty degrees, with a small gas- or coal-oil stove. By this means you have the temperature of your silver solution under complete control all day, if necessary —H. A. Webb.

toning-bath; acidity of the toning-bath; using the toning-bath immediately after making it; and, finally, too little gold in the bath. Washing the prints too long before toning also tends to make them mealy, besides being injurious in other respects.

289. Although the great annoyance of blistering of the albumen has been alluded to (see Lesson M), another caution as to its prevention may not be lost here. Albumen-paper manufacturers have been appealed to in this matter, and have succeeded more largely than heretofore in remedying the trouble. It is most liable to occur with doubly albumenized paper.

290. It has always been a blot upon the fair face of albumen printing, that the more delicately beautiful its products, the more they were apt to fade. The prime cause of this is the imperfect washing which the prints are allowed to have. This should be a matter of conscience with every photographer. He should use all the means in his power to secure the *thorough* washing of his prints, and in no respect allow any carelessness on the part of his assistants. And yet it is indeed difficult sometimes to eliminate the hyposulphite of soda (the undoubted fading element) from the prints, wash them as you will. The operation is largely helped by Mr. Clemons' alum treatment, given below in his own words. It is so easy of application that it should not be overlooked as one of the means of preserving the fame of our art.

289. To prevent albumen blisters, first immerse the prints in a freshly prepared and strong fixing solution, and then pass them into a weaker one. Then wash the prints in a small quantity of water first, and gradually increase the supply as the washing progresses. This treatment will thoroughly prevent the blistering of albumenized paper.—J. L. Gihon.

Pour into a bath some rectified spirits of wine and distilled water in equal parts. After the washing operation which follows the toning, the prints are plunged into this bath, which may last a long time. The immersion of five minutes suffices, and then the paper will be seen to be more transparent. After this bath the prints should be washed once only, and then fixed and finished in the ordinary way.—Mons. Andres.

290. For eliminating the prints completely of hyposulphite of soda in from eight to fifteen minutes, make a saturated solution of alum and water. After the prints are fixed, immerse them in sufficient of the solution to cover them; let them remain two or three minutes, then pour off and throw away the solution, and rinse off the prints one or two minutes, and repeat this operation twice, and finally rinse the prints well. The result will be the same if the prints are allowed to remain in the solution, after the first immersion being the same as described, the prints being rinsed well after each immersion. No traces of hyposulphite of soda will remain in the prints after going through this process.—John R. Clemons.

If you use alum, do not tone so much, and use less gold, as the alum makes the prints two or three shades darker than the gold and hypo leaves them.—A. Hesler.

291. There are various other perplexities which will come up in the practice of photographic printing, among which may be mentioned the abrading or cracking of the surface of the prints after they are dried—sometimes called "woolliness;" the cockling or wrinkling of the paper under the pressure-frame, and finally a *very bad* defect, the distortion of the image caused by the contracting and stretching of the paper. Good practical ideas on all these are given in the notes, to which be pleased to refer.

291. The cause of cracks or flaws lies in the excessive dryness of the albumenized paper during the various photographic operations. With the exercise of a little attention and practice, it is possible to tell whether the unsensitized paper is inclined to crack. Extraordinary brilliancy is generally a sign of this weakness, although it must not by any means be inferred that all brilliant papers are open to this objection. The first condition is that the paper should not be preserved in too dry a state, nor allowed to roll up. Very dry paper, on being sensitized, possesses, besides, the disadvantage of repelling the silver solution, which hangs upon the surface of the paper in drops. After sensitizing, the paper must not be dried too rapidly nor too highly, and should be suspended from two corners to prevent its rolling up, a precaution also requiring strict attention when the pictures are taken from the water after washing. Finally, they should be mounted in a slightly moistened condition, as, when kept in rolls in a dry state, the defects above referred to are easily developed on rubbing the paper-folder over the albumenized surface.—Oskar Pfeiffer.

The following, if not one of the "wrinkles," is one way to avoid them. In making prints from large plates, the printer is often troubled by wrinkles or cockles in the middle of the sheet which no amount of padding or pressure in the frame will bring in contact with the negatives. To remedy this, after silvering, and before the paper is thoroughly dry, fasten the sheet by the corners to the fuming-frames, or locking these to a large board or anything that will keep it out straight, and allow it to get as dry as usual. Then give the *middle* of the sheet an extra dry over a lamp or gas-stove, and the paper, instead of bagging in the centre, will have all its wrinkles near the outside, and, when printing, will be found to lie against the negative "as close as a cat to a hot brick."—J. L. Gihon.

Observe that the expansion and contraction are not equally proportioned to all dimensions of the head, both being much greater in proportion to the breadth of the face than to its length, so that either print is *distorted*, which in the case of an *equal* mobility of the parts of the paper would not be; the paper contracts and expands nearly *three times* as much across the narrow way of the sheet as in its length. This is an important, constantly present, and, it seems to me, unavoidable cause of photographic distortion. Let both of these heads be magnified to life size, in length, from the outer right-hand corner of the mouth to the inner corner of the right eye, two-and-a-quarter inches, and the divergence in width would become comparatively enormous. Let now the head be carefully traced by the hand, following the solar camera image of the negative, and a third scale of dimensions is produced. Print from the negative, in a solar camera, with the length of the paper placed across the width of the face, then another print with paper placed with its length parallel to the length of the face, and you have a fourth and fifth scale; under all conceivable conditions this cause of distortion remains.—W. J. Baker.

LESSON R.

ART IN PRINTING.

292. As has already been suggested, there is a wide field for the exercise of artistic taste in photographic printing, and the Lesson A is quite as deserving of the study of the printer as of the gentleman who poses the model. Indeed, if the printer is ingenious and full of feeling for his art, he will oftentimes be able to improve upon the negatives given him to print, by exercising his art-knowledge, and by resort to the many little subterfuges that will suggest themselves in individual cases, and which can be hardly described in a book. He should know that his results must be brilliant; there must be a proper contrast of light and shade, which may be regulated or not, according to the nature of the subject and the pose, and the tone, too, must be managed to suit the character of the whole. Again, negatives must be humored and "doctored" and "im-

292. I first print the portrait in the usual way, leaving large masses of pure light, or, at any rate, tones, which, if toned and fixed at this stage, would represent white when finished. On removing the print from the pressure-frame I fit carefully over it a plate of glass of the same size, on which I make sundry opaque marks—spots or streaks, as the case may be—by means of any opaque body, such as water color, oil color, or varnishes. The exact spot where this opaque body has to be applied, is ascertained by interposing the plate of glass between the negative and the eye, a strong source of illumination being behind both, and touching out here and there those points and spots where the highest light is wanted, such as on the eye, the ridge or tip of the nose, the shirt, breast, etc. When a glass is thus prepared, it is placed over the printed and still sensitive photograph, now removed from the pressure-frame; and, the greatest care having been taken to secure perfect registration, the picture is exposed to the light for a sufficient time to allow a decided tint to be printed all over, except, of course, in those parts covered by the opaque touches on the plate of glass. The effect of this second exposure is that the whole of the picture previously printed is lowered in tone. with the exception of the touches referred to. Some parts—as, for example, a touch of light on the eye—should be sharp and well-defined; others may be softer and vignetted, so to speak, in the surrounding semitone. The former is obtained only by the opaque stopping being effected on that side of the glass placed next to the print. Softness of outline, on the contrary, will be obtained by working on the side of the glass farthest removed from the paper.—EDWIN COCKING.

proved" and managed in various ways, some of which will be described, and others will be found in Mr. Hearn's more elaborate work on this part of our art, the *Practical Printer.* "Style" also is to be regarded in printing as well as elsewhere.

293. To print fast or slow, that is the question. On this subject doctors do not disagree in theory, but they do in practice. Undoubtedly, the slowly printed results are the richest and the best, but in practising our art, one would never obtain sufficient prints by any slow means of producing them. Consequently, moderately rapid printing must be resorted to, and negatives are made accordingly. It happens sometimes, however, that they are too weak. Then ground-glass, a varied number of sheets of tissue-paper, an opaque coating, or other means is used to retard the action of a too rapidly printing negative, and often it must be treated in other ways, too, to secure from it the best possible results.

293. **I have seen negatives of that grade that the finest prints could be obtained from them if the light was diminished by covering them with five or six sheets of green window glass. This shows that the negatives have no photographic opacity of themselves, which must be conferred upon them by a weak light. Indeed, they possess all the qualities of a fine solar camera negative. I have tried to obtain negatives of a similar character, and believe I have succeeded by using the following developer: Mix two solutions, one of**

Water,	1 ounce.
Nitrate of Baryta,	25 grains.

The other of

Water,	1 ounce.
Protosulphate of Iron,	45 grains.

A white precipitate (of sulphate of baryta) is formed. Filter off the clear solution, and mix with

Acetic Acid,	30 grains.

Expose fully, and apply the developer until all details of the shadows have appeared. If the light was good, and a short-focus lens has been used, no intensification is necessary. The negatives were very ably retouched by the brush with carmine; and in some places of very clear shadows the glass side of the negative was covered with carmine. No pencil touching has been used with them. I may here mention that a few of our professional photographers adopt the same course in printing, and go even so far as to say that no print can be good if produced in less time than a whole day. They print under a glass roof, and through roughened glass, in order to give the print as diffused a light as possible. Strangely enough, the same effects are produced if we protract the time used in printing by diminishing the amount of chloride in the sensitive paper. I prepared three batches of albumenized paper with four, two, and half per cent. of chloride. The highly salted paper printed in half the time the half per cent. paper used, and the prints were so different that it seemed doubtful whether the same negative had been used for the two, although this had been done. The less chloride used the less sensitive the paper, and the more contrast between light and

294. Again, the negative may be so dense as to print not only slowly, but to yield harsh and hard results impossible to tone with any degree of richness. This occurs when the plate has been undertimed, or too unwisely intensified. There are those who like "black and white" pictures, but nothing can be more disgusting to an artist with cultivated taste than a print utterly devoid of delicate half-tones—coarse and hard and harsh. To prevent such, whether the order warrants it or not, for your own name's sake, "doctor" the negative so it will have a chance to do its best.

shadow. For what we call a negative of ordinary printing density, a paper salted with two per cent. of chloride of ammonium is generally the best.—Dr. E. Liesegang.

To get bold prints from flat negatives, cut a piece of tracing-paper about the size of the negative; with a little dab of paste in each corner, attach it to the *back* of the negative. With a No. 2 Faber pencil lightly touch up the lights *on the paper*, softening the strokes by rubbing with the ball of the finger. Great care must be used in doing this to avoid harshness or unnaturalness in the lights. Turn the negative over, and by looking through you can decide whether there is enough or too much lead on the paper; in the latter case, remove the surplus with a common pencil-rubber; cut this to a sharp point, and you can obtain the utmost accuracy and gradations in your retouching on the paper. A negative thus doctored should be printed under ground-glass; and thus a soft, bold print can be obtained from a weak, flat negative. Care, practice, and judgment are the chief necessaries to obtain success in this manner of manipulation.—John L. Gihon.

294. The method I adopt to conquer all the difficulties is this: eschewing retouching with brush or pencil on the film, risking the further deterioration of the negative, I make light finish the task it has, from want of time or bad quality, insufficiently done, and in such a manner that no hand can hope to rival its delicacy and precision, and this is the only plan that a lover of his calling can justifiably pursue. A cliché produced under the conditions before made will present the high-lights of the face, the light parts of the costume, white lace, white lace collars, sleeves, etc., in violent contrast with the darkly shadowed parts of the face, under the eyebrows, under the chin, portions of the hair, dress, and accessories. I take the negative and place in contact with the collodion film a sheet of thin, yellow-colored tracing-paper the size of the plate. This I rest against the glass square of the window, so as to cause the light to traverse the two. I then sketch with a pencil the outline of all those parts which are too strongly intensified on the negative and require tinting. I then remove the tracing-paper and cut out with the fine point of a knife the pencilled parts corresponding to the dark parts of the cliché; and I lay down in the printing-frame this tracing, which may be called the tinting-paper, and cover it with a sheet of sensitized paper, and expose to diffused light. It is here that the judgment of the printer is brought into operation, for some of the apertures will require more or less exposure to rectify the defects of the negative, and which should be covered up with any non-actinic substance until the whole of the uncovered portions of the sensitive paper have acquired the necessary tint, the yellow-colored tracing-paper preserving the rest from the action of light. Some of the outlines of the tinted portions may be lightly pencilled on the back, to facilitate the adjustment of the sensitive paper to the negative in the printing-frame, the shutters of which are then closed, and the whole is exposed to the light until the print has acquired the necessary force, when it

295. Thus it will be seen that much may be done to modify the nature of a negative. It may be still more elaborately changed, and additions made to it by the use of the pencil and various other means. A patent has been obtained for a process which consists in holding the plate over a gas flame or lamp until it is fairly smoked, and then with the stump and brush working up such additions and alterations as are wished for in the way of backgrounds and accessories. An *artist* may produce very tasteful results in this way, but it has caused some very evil effects to be offered to the public.

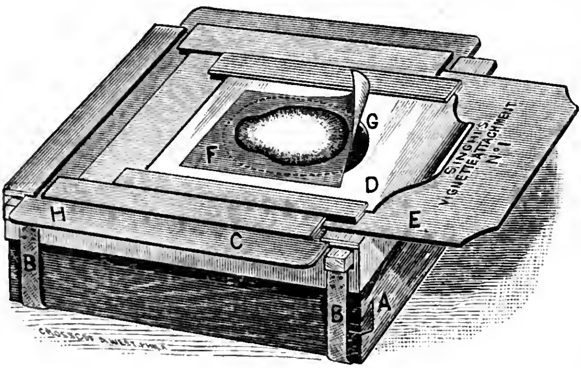
will be found that the tinted parts have now all the details of the photographic image in a most surprising manner, not otherwise obtained. It is as if those parts previously exposed had been rendered more sensible from some contaminating action; there are no lines nor overlapping, but the image is beautifully modelled, and the first tinting disappears in the production of a complete picture, the agreeable result invariably obtained when the operation has been carefully executed by any person worthy of the name of a photographic artist.—ADAM SALOMON.

Here is a hint for producing improved effects in portraits or landscapes, and no patent for it. I hope it will not be cast away because it is cheap. Place a piece of glass on the collodion side of the negative, and, looking through the two, you will see what effect is wanted, and where. With sepia, Indian-ink, or any water color, paint upon the plain glass the effect you wish it to be upon the finished print—say clouds, or anything that is pleasing. This is all supposing the negative to be taken with a white background, or masked. Then take a piece of sensitive paper fine in texture by a transmitted light, and print that which you have painted upon the glass; you may darken the centre where the portrait falls in a vignette form, if you wish it, so that no mask will be required. When this print is fixed, wax it, and then use it to print in the effect in the print after the portrait is printed. This prepared negative, I will now call it, on paper, will do for any number of varied portraits.—JOHN EASTHAM.

295. The practice of touching up negatives on the back has long been resorted to with more or less success by photographers, and when skilfully applied is of great value as a means of enhancing the effect of their work. The method generally adopted for the purpose of producing a surface adapted to receive the lead-pencil or other material employed, is to cover the back, or a portion thereof, with tracing or other thin paper; but it is open to the objection that, unless the back be covered entirely, and the progress of the printing necessarily impeded, a line is produced wherever the material is brought to an edge. In the plan I am now about to describe this disadvantage does not obtain, as the edge of the retouching surface may be softened off to any desired extent. The process is as follows: Place the negative to be operated upon face down on a pad of blotting-paper, and distribute a small quantity of emery powder and a few drops of water over the portion you wish to modify; then with a piece of glass (I use a cube of about an inch and a half) grind the back with a circular motion. This, when sufficiently done, will give a grain of about the same quality as that of an ordinary focussing-screen, and one eminently adapted for working upon with black-lead pencils. Clouds may be put in by an artist very effectively with a blunt piece of black-lead on the back of landscape negatives, the lights being heightened with Indian-ink. Of course

296. Photographic prints as a usual thing are divided into two styles—the "plain" and the "vignetted." The former are such as are printed from the negative without masking or obscuration of any kind, and the latter are such as are tastefully blended off from the darkness of the figure towards the outer margins. To accomplish this last effect a great many devices are used, the simplest and best of which are known as Waymouth's Vignette Papers. They are lithographic designs very carefully gradated, printed on superior tissue-paper, and placed over the negative at a short distance therefrom, during exposure to the sun. Several devices have been invented and suggested for adjusting these vignette papers to the negative, the best of which seems to be the invention of Mr. J. F. Singhi. The drawing annexed shows his device in use. A is the printing-frame supposed to contain a negative: over the face of it a light, close-fitting box, about one inch deep, is fastened and held in place by the gum-elastic bands, B B. At each end of the box strips are fastened, forming slots in

Fig. 68.



the result will entirely depend on the amount of artistic skill brought to bear on the operation; but by the judicious use of pencil, brush, and stump, very fine effects in the way of clouds may be produced. It will sometimes happen in an otherwise perfect negative that, owing to the falling off of light towards the edges, the picture will print with dark corners, or one side may be wanting in density from inequality of the film of collodion. In such cases, by the above process of grinding as far as necessary into the picture, and then rubbing in black-lead, the natural effect will be rendered with much greater perfection and delicacy. When the work is completed, if it be thought desirable, the whole may be varnished with negative varnish applied in the ordinary manner; it will thus be fixed, and the untouched part will be restored, or very nearly so, to its original transparency. I should add that for this process it is necessary that the negative should be taken on patent plate glass, and, writing from my own experience, I would earnestly recommend photographers to use none other for all good work.—William Bedford.

296. When I have a negative which prints too dark for a nice vignette, I treat it in the following manner: Varnish the glass side with Hance's Ground-Glass Substitute; then, with a dusting-brush, dipped in plumbago, proceed to work on sufficient to get the required inten-

which the slide, C H, freely moves from right to left. C H is also provided with strips, forming a second series of slots in which the next slide, E, freely moves in and out. Over E is a third series of slots, in which the slide, D, moves, provided with an opening, G, of any desired size or shape, over which opening the Waymouth Vignette Paper, F, is pasted, but turned up at one corner in order to show the opening, G. Now, by means of these slots, it will be seen that once the vignette paper and negative are brought into relation to each other, and held up to the light, the arrangement of slots and slides permits the nicest and speediest adjustments to be made, when the printing may be proceeded with. As the attachment fits the printing-frame by friction, it is raised and lowered to the right distance required between the negative and the vignette paper by means of wooden strips inserted at each end, and tapered to suit. The arrangement is very complete, and its results are all one could desire. The vignette printer will remember that the farther the vignette is away from the negative, the more gradual will the gradation be, as well as softer and wider in effect. Used with taste, this device renders artistic vignette-printing a matter of easy accomplishment. Negatives which are to be printed for vignettes should be made with a light background, and never intensified.

297. There is still another style which is very pretty, known as the

sity, being careful not to get any upon the figure; then, with a soft pencil, work up to the figure, making an even coating. This might be taken advantage of to work in clouded grounds if the operator be skilful. I have often made clouds in stereo-negatives by use of the pencil on the ground-glass substitute; I also use it much in copies to strengthen high-lights. In fact, I could not keep house without this valuable *substitute*. . . . One more hint about using Hance's Ground-Glass Substitute. Should it, in flowing, have a tendency to run over the edge and get upon the varnished side, go around the negative, before flowing, with a piece of beeswax. It will prevent the evil.—IRVING SAUNDERS.

If they are to be judiciously used, it is necessary the Waymouth vignette should be removed from the negative all of the way from one-half to one and a half inches, depending somewhat upon the negative and the degree of softness desired to be obtained. The frame is built up with strips of backboard, and the vignette paper fitted to the negative through transmitted light, and then it is tacked in its proper place. They are easily adjusted, and have the advantage of being already made, thus saving the time of the printer in cutting this and that size form out of card-board, which, when done, caused not only a waste of time, but also, except, perhaps, in very rare cases, is not nearly as good.—CHARLES W. HEARN.

297. In printing the medallion style, now so very popular, nothing can be more simple than the plan adopted at my establishment. A piece of silvered paper (or a worthless print before washing will do) is exposed to the sun until it is fully blackened. This is laid upon a piece of glass, and a brass mat, the size and shape you desire, put over it, and, by means

"Medallion" or oval. To secure prints by this method, Gihon's "Cut-Outs" are used, which consist, first, of a mask of any form, but generally with an oval opening in the centre, which is placed over the negative margin or border during the printing of the figure; then the figure is covered over with a piece corresponding to the oval cut-out, and the border of the print is "flashed" in the sun, more or less according to taste. There should always be a contrast between the figure part and the border, the latter being much the lighter of the two.

298. Like human beings, again, negatives "wear out" from much use. If the film becomes torn, it is easily remedied by the application of a spot

of a sharp knife, the oval is cut neatly out, care being taken to preserve the *piece* cut out. This latter is stuck permanently in the centre of a suitable sized glass. The opening is now laid over the negative, on the varnished side, of course. The print is made as usual. Remove it from the printing-frame, and cover the printed oval thus made with the glass containing the cut out *piece*, when you may now expose and *tint* to any desired degree. If you wish to have a fine line border, all you have to do is to shift the *piece* about one-thirty second to one-sixteenth of an inch, in any direction, whilst laying it over the printed oval, which, by thus covering an edge of the white paper alongside the oval, preserves the paper still white during the tinting.—William Kurtz.

298. No matter how much care is used, it frequently happens, in the printing of a large number of copies from single negatives, that specks of dust or dirt will inadvertently settle between the sensitive paper and the plate. They leave white marks, which do not sufficiently mar the print as to make it worthless, but which become in a measure eyesores to the critical purchaser. They have to be made of the same color or rather tint of the surrounding parts. A dab of Indian-ink, jabbed upon the offending spot, does not answer the purpose at all. As much judgment has to be used as is exercised by the lady who trots from store to store upon a shopping excursion, and expends hours in the matching of the hue of a dress pattern or a set of ribbons. If you cannot touch on the spots neatly, you had better allow them to remain. On numberless occasions I have seen prints from what were supposed to be good negatives, that might readily have passed for maps of the heavenly constellations. They were filled with white spots, crescents, and lines. I have frequently asked the privilege of inspecting the plates from which they were made. In most instances the printer had endeavored to conceal small pinholes or light scratches with that very useful paint of my manufacture (Opaque), and instead of having a scarcely discernible dark speck on his paper, caused the appearance of a white blot, somewhat difficult to eradicate. To remove these transparent imperfections upon the negative, you must possess a sharp eye, a steady hand, a fine brush (Opaque, of course), and a clear comprehension of what you are doing. Almost invariably, when I have washed away the color that had been applied, I have found that at least three times the necessary quantity had been used.—John L. Gihon.

For several years I have made a practice of subjecting my negatives to an operation which has had the effect of preserving them in good condition; thus I have some ten years old, from which several hundreds of prints have been taken, and all of them possessed of the same degree of clearness and beauty. My manner of working is as follows: The negative,

of that indispensable obscurer of light in the wrong place, Gihon's "Opaque." If the varnish becomes generally demoralized, then more elaborate treatment must be resorted to. The varnished film may be removed and the negative revarnished without great risk, but it is a delicate operation and should be managed with the utmost care.

finished and well washed (no trace of hyposulphite being allowed to remain in the film), is coated with the under-mentioned solution:

Water,	30 cubic centimeters.
White of egg,	30 " "

Well shaken, and, when subsided, filtered.

The negative is allowed to dry spontaneously. Attention must be paid to the proportions of water and albumen employed, for if the latter is in excess, the film of collodion, when dry, has a tendency to peel off, especially if the same has been much worked during development. The albumen having dried, the negative is plunged into a fifteen per cent. solution of silver, the silver bath used for sensitizing being employed for the purpose, if necessary. The plate remains in the silver solution for a period of thirty or forty seconds,—sufficiently long, indeed, to coagulate the albumen,—and is then removed and passed into a bath of concentrated hyposulphite of soda. It is then again washed, dried and varnished at a gentle heat with a solution of

Benzoin,	5 grammes.
Alcohol, rectified,	100 "

When this coating of varnish has become worn out, it is removed by immersion in a bath of alcohol of the same strength as above, the negative washed, if necessary, and again varnished; it is thus again restored to its pristine beauty.—M. Clement Sans.

If a negative has been printed in the direct sunlight, and has consequently had its varnished surface injured, by placing it on the developing-stand, carefully levelled, and allowing chloroform to remain upon it a few minutes, the injured surface will be dissolved, and it can be revarnished when dry. Observe that a few hours should be allowed to elapse before printing from the newly varnished negative, or it may probably suffer by adhesion to the paper.—Lake Price.

For removing stains from old negatives, dip a tuft of cotton-wool into the hypo fixing-solution, which has been used for the prints the day before. (Strength should be about five ounces of hypo to a pint of water.) Work with gentle friction upon the damaged part, and after a few minutes the negative will be able to discharge its printing functions with all its former power. After the treatment, wash the plate carefully with plenty of water, and dry with blotting-paper first and a soft linen cloth afterwards, finishing with a little gentle heat from the fire.—John L. Gihon.

LESSON 8.

MOUNTING AND FINISHING.

299. AFTER all, the operator and the printer are at the mercy of the mounter and the finisher, unless that person also puts heart in the work, and labors with the rest to produce beautifully finished results. Neat and good cards should be used; the trimming and cutting should be thoughtfully done, so that the figure will appear in proper position upon the card—neither too high, too low, too far back or too far forward or crooked; the prints should be placed so that the margin at top and sides of the card are equal, and smoothly and thoroughly pasted all over. Starch

299. A good photograph badly mounted is like a jewel ill-set, and a great part of its beauty is lost. No artist should be indifferent to the manner and style in which his work is shown to the public. Nothing fanciful should be allowed in the mounting of a carte-de-visite. The card should be plain, either white, or, what is perhaps better, a very light buff or cream color; the margin should not be wider than one-sixteenth of an inch, with a quarter or five-sixteenths of an inch at the bottom, upon which it is allowable for the photographer to print his name, very faintly, in black or brown ink; but to print the name large, or in red, staring letters, not only shows bad taste, but detracts from the effect of the picture. Printed lines round the edge of the card are wrong, so are round corners, but when the lines and round corners are combined, as I have seen them in some American cartes, they appear to have entered into a conspiracy to spoil the picture, and generally succeed, however good it may be. I hold it to be as necessary to have the photographer's name on the back of the card—always supposing the picture is not a copy—as it is to have a picture on the front; but the name must not be set forth in a glaring design, full of curlycues and flourishes, but in a modest and quiet fashion; not as though you were ashamed of it, but without any advertising dash. A thin card is better than a thick one; it feels better if well rolled, and does not fill up the book so much as a thick one would. To cabinet pictures the same general rules will apply, except that the margins should be proportionately wider.—H. P. ROBINSON.

The material I am about to describe for paste, has advantages which no others possess. Take

Best Bermuda Arrow-root, ...	1¾ ounces.
Sheet Gelatin, or best Russian Glue, ...	80 grains.

Put the arrow-root into a small pan, add one ounce of water, and mix it thoroughly up with a spoon, or the ordinary mounting-brush, until it is like a thick cream, then add fourteen ounces of water and the gelatin broken into small fragments. Boil for four or five minutes, set it aside until partially cold, then add one ounce of methylated spirit and six drops of

paste is the cleanest and the best. It is simply good laundry starch, mixed with clean water, and used cold. Pour cold water upon the starch to barely moisten it. Then stir in *boiling* water until the proper consistency is reached. Strain, if not free from lumps. The prints are best mounted damp, being laid in a pile backs up, and pasted one after the other as wanted.

300. After mounting, the prints are to be "spotted," *i.e.*, all light spots removed by the use of a camel's-hair pencil tipped with Indian-ink or color. This should be carefully and neatly done, and the work hidden as much as possible. The pictures should then be rolled in a press and polished with encaustic paste.

pure carbolic acid. Be very particular in adding the spirit in a gentle stream, stirring rapidly all the time. You have now fifteen ounces of the best mounting material you have ever used. Keep it in a corked stock bottle, and take out as much as may be required for the time; work it up nicely with the brush, and you will have a material as smooth as cream, without lumps or grit, and which will not decompose.—J. G. TUNNY.

After many failures in mounting prints on toned card-board, the following means of overcoming the greasiness of the surface was discovered. It is done by adding to every hundred grammes of paste five grammes of ammonia; this hurts neither the paste nor the pictures. The grease of the mount is slightly dissolved, and the picture adheres closely to the board. The volatile alkali evaporates very quickly. The ammonia used for this purpose must be perfectly pure, and free from any trace of sulphuretted hydrogen.—JOHN L. GIHON.

300. For "touching out" plain photographic work, I advise you to have by your side a palette, upon which are ground moderate portions of a good *black* Indian-ink, warm sepia, and scarlet lake. With combinations of these you can readily imitate the photography upon which you are working, whether it be cold or warm in tone. Of course, it is necessary to apply these tints with a brush, and if you use plain water as a dilutant, you will leave a dead surface that betrays your trail. Every one will exclaim: Why not then use gum water? That will leave a gloss. Perfectly right! but it leaves too much gloss. In addition, I don't believe that the half of you know how to make gum water. Accept my formula, and adopt it or not, as you see fit.

Picked Gum Arabic,	1 ounce.
Loaf Sugar,	1 drachm.
Acetic Acid,	39 minims.
Alcohol,	30 "

Water in sufficient quantity, say, from six to eight ounces.

Don't be frightened at the mention of the acid, and at the idea of putting a modicum of it upon the surface of your photograph. Used in this way, it will not, I assure you, prove destructive in the slightest degree. The gum water, however, I do not use for the indicated purpose. There is a better vehicle—the much-abused, always useful, *albumen*.

The value of an encaustic paste in giving depth, richness, and transparency to the shadows of a photograph, and in bringing out the delicate gradations in the whites, is now so well known that it needs scarcely to be stated; and it is tolerably clear, also, that it adds to the

301. Or some may prefer a higher polish, when the final operation is to pass our beautiful new pictures through the now popular heated burnisher, which imparts to them a high degree of polish and improves their tone. If this latter is used, the prints must first be lubricated with a mixture of white Castile soap and alcohol, or a similar "lubricator." After either treatment, the prints are ready for the acceptance of your

permanency of the prints. My prints owe much of richness and depth to treatment with an excellent preparation of this kind, the formula of which stands as follows:

Pure Virgin Wax, ...	500 grammes.
Gum Elemi, ...	10 "
Benzole, ...	200 "
Essence of Lavender, ...	300 "
Oil of Spike, ...	15 "

Those who wish to try a small sample can substitute grains for grammes. Melt the whole on a water-bath, mix thoroughly, and strain through muslin. A simpler plan will be to dissolve the elemi in the solvents, as described above, and, after filtering, mix with the melted wax, as the filtration, which is chiefly intended for the gum elemi, is more easily managed before the wax is present. This, when finished, forms a stiff paste. By increasing the proportion of essence of lavender it can be made thinner, which in winter may be desirable. The encaustic paste is put on the print in patches in three or four parts, and then rubbed, with a light quick motion, with a piece of clean flannel, until a firm, fine surface is obtained. If a rich, thick coating of the encaustic be desired, a very light pressure in rubbing is necessary, so that a polish may be acquired without rubbing off the paste in the operation. If a print be retouched, more especial care is required to use a light hand in applying the encaustic paste.—ADAM SALOMON.

301. First, after prints are dry, spot out, and before burnishing, rub them briskly with a cotton-flannel patch saturated with either white or common yellow wax, it matters not. After the wax is applied to the patch, let it get cold or nearly so; cold enough not to stick to the print, and warm enough to be pliable. Begin rubbing lightly until the wax and patch get a nice polish. If any bits should get stuck to the print, they can be readily rubbed off with a clean patch. This, properly applied, I find preferable to any other; it fills the grain of the paper, and does not remove the spotting, and the prints will bear handling without injury. Second, keep the burnisher well polished. Take a smooth piece of pine, about two and a half inches wide, one inch thick, and thirty inches long; on one side of this apply flour of emery and kerosene; spread it over smoothly. To begin with, lay the prepared stick down face up; over this pass the face of your burnisher (if it scratches) until the face is true, and all scratches removed; now have a similar stick, over one face of which is stretched a piece of buckskin, similar to what we used to buff Daguerrotype plates with; apply to this jeweller's rouge, and finish the polish of the burnisher with it; you have now a polish that can't be beat.—A. HESLER.

First, see that the picture is not too much dried, as all know the swell of the card when a picture is first mounted bends the picture backwards. Let the picture dry until the contraction of the paper just commences to bend the picture forward. It will be found that the picture in this stage is about three-fourths dry, and it is absolutely necessary that it should not be allowed to dry any more than this until after it has gone through the burnisher.

patrons. The neat and thoughtful photographer will show enterprise, and deliver his work in tasteful cases or envelopes, and allow no print to pass his counter that will not do him credit in every way, and serve to bring him an additional patron. He should feel as if his future reputation depended upon the pictures being delivered *now*.

This is best done by piling the pictures in one or two piles, and placing them under a weight. They should be carefully taken from this pile and spotted out, and immediately placed in another pile under weight. The same precaution should take place in applying the lubricator to the print. They should be taken to the burnisher in this condition and put through until a sufficient polish is reached. The reason for this method of procedure will be evident to any one who has observed with what a number of irregular lines the surface of a picture will become broken when allowed to become perfectly dry in the usual manner. When these checks have once appeared in a picture, there is no method of again uniting the broken surface, as I have repeatedly demonstrated by all sorts of experiments. When burnished by the above directions, the picture, when cool, will be found to be very compact and hard, and neither alcohol nor water will destroy the gloss, except by long soaking. Another little hint I would give on the best way to handle a picture in the burnisher. Just put the picture through the burnisher lengthways, curling it up backwards around the roller; afterwards put it through sideways, thus straightening it, and thereby a much higher polish will be secured.—J. H. SCOTFORD.

If occasionally a cabinet or card picture will not take the gloss, breathe upon it freely, run it through the burnisher, and behold the *shine*. Should it not be produced the first time of trying, repeat the operation after the picture has become cool; the desired result will then be obtained.—C. J. STIFF.

About two years since I was very much troubled with very fine scratches in burnishing, different from those caused by roughness of the burnishing tool. Another proof that the cause lay outside of the burnisher, was that two or three, perhaps, would burnish all right, then one scratched badly, next all right, and so on through the lot. I finally found the cause to be that the prints were allowed to get too dry before burnishing, and the remedy I used was as follows: After mounting, the moisture should not get out of the prints before burnishing. As soon as the prints begin to curl towards the picture, I pack them one upon another. My first plan was to place them in the cellar until ready to spot; while doing this I only expose one print at a time, keeping them packed. After spotting, lubricate with soap and alcohol (I find wax, spermaceti, etc., to give, in my experience, a veiled appearance), and spread out in the cellar upon something clean. I use a cloth stretched upon a small frame, where they should remain until ready to burnish. A superior burnish will result if they can remain twelve hours after lubricating, as directed, spread in the cellar. I have since made another improvement, substituting for the cellar a tight tin box, which I had made large enough to hold my prints flat. Care must be taken not to have the prints too damp. I run them through, lightly, twice across the burnishing tool, until all are through, then run about four times again, commencing with the first; I run the first thin.—IRVING SAUNDERS.

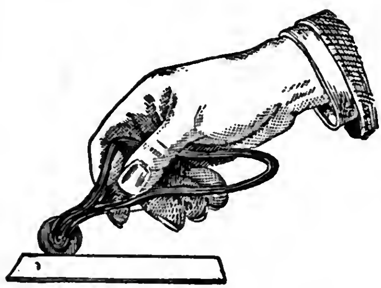
I find the following to serve admirably as a "lubricator:" A. Paraffine, eight drachms; benzine, ten ounces. B. In a mortar grind gum ammoniacum thirty grains, in alcohol sufficient to prevent the gum from sticking to the pestle. Add A and B together, shake well, and apply with a flannel rag or sponge.—JOHN R. CLEMONS.

302. A still higher polish may be given to the print by coating it with a mixture of gelatin. It is questionable whether such a high degree of "shine" is "artistic" or not; and it is an absolute certainty that the gelatin film turns color and gives the prints a faded appearance. Moreover, the surface is easily abraded.

303. The trimming of the photograph should always be neatly and carefully done. The edges should be untorn, and the form or shape should be true. A knife is often used with a glass or metal form, but the little invention of Prof. S. M. Robinson, known as his "trimmer," has almost displaced the knife. These trimmers are made of two forms, the one illustrated by Figure 69 being constructed so as to revolve in a socket, in order to make it follow accurately an oval or round-cornered metal "guide," and the one in Figure 70, known as the "straight cut," is for trimming straight edges, a metal guide being used also with it, or it may be worked outside of a glass shape. The theory of these trimmers is, that instead of *cutting* they *pinch* off the surplus paper, thereby giving a nicely-bevelled edge to the print, and they are far superior to the knife or scissors if held and used as indicated by the drawings. The first named gives a small turned or rounded corner to the print, which causes it to adhere more neatly to the mounting card. The "straight cut" trims the corners square. The guides are made of sheet-iron, and are cut true by means of a lathe.

FIG. 69.

FIG. 70.



302. This way of mounting photographs may not be quite new. The print for this purpose should be a little darker than usual, and fully toned, and after well washing, put between blotting-paper for a short time, and when surface dry floated on the following solution made warm:

Isinglass,	5 grains.
Gum Arabic,	1 grain.
Water,	1 ounce.

304. One great difficulty in mounting, which should not be overlooked, is the cockling or distorting of the card-board, by the unequal drying out of the moisture imparted to them by the mountant. A good preventive is to slightly dampen the cards, and then print and card will dry together, though still, alas! not always equally and in concord. Never pile the prints in close contact while damp, in order to keep them straight. They are apt to become soured, and spots will follow to their ruin.

A gentle heat will dissolve the isinglass and gum; then add one drachm methylated spirit, and filter. Float the damp print upon this, and then lay it carefully on a plate of quite clean, clear glass, say patent plate. Now press out the superfluous mixture with a squeegee (or a piece of Indian-rubber tubing will do for the purpose), beginning at the centre of the print with a gentle scraping motion; then allow it to get thoroughly dry. The print will now have all the brilliancy of prints in water; and much detail will be visible that in the ordinary way would not be seen.—THOMAS GULLIVER.

304. Take half an ounce of gelatin and cover it with water; leave it to soak for, say, twenty-four hours, in which time it will become thoroughly swollen. Now pour off all the superfluous water, except two or three drachms; place the gelatin with this trace of water in a glue-pot, and put it on the fire. When it is melted, add six ounces of alcohol; that which I use has a specific gravity of .820. A most important point, however, is the mode of mixture; the alcohol must be added a little at a time, stirring steadily with a glass rod, and maintaining a moderately high temperature. By proceeding carefully in this way, perfect mixture is secured; and the solution is then poured into a wide-mouth bottle, corked or stoppered, and set aside for use. This, applied to the print, causes a scarcely appreciable degree of expansion, and no subsequent cockling. Its adhesive qualities are perfect, and the preparation keeps well. To prevent the rigid hardness which characterizes good gelatin, I added from one to two drachms of glycerin to the preparation, which is, I think, an improvement.

To mount in an album without cockling, let the photograph be ironed with a hot iron on the back till it is nice and smooth, then place it under pressure till quite flat. A large book answers the purpose admirably. To prepare for mounting, lay the flattened print face downwards on a smooth board or piece of glass, and upon it place a piece of clean, stiff paper an eighth of an inch less all round than the photograph, upon the exposed edge of which rapidly and *sparely* brush some liquid glue (as little as possible) to cover it, for herein lies the great secret. Avoid making the paper wet. The album being conveniently placed—the position the photograph is to occupy being previously marked with a pencil—carefully raise the photograph with a point of some kind to avoid soiling the finger with the glued edge, making it non-adhesive in the parts where such glue would be removed, and lay it down in the proper place. At once lay a piece of clean paper over it, and rub it down firmly with a soft rag; close the book. In half an hour the face will be dry, and the print perfectly flat, and it will remain so.—JOHN L. GIHON.

LESSON T.

PHOTOGRAPHY OUTSIDE.

305. THE suggestions which follow are for the practice of landscape or out-door photography especially, though embracing what is helpful also in making architectural subjects, interiors, groups of persons out of doors, and in fact all classes of work outside of the studio. Landscape photography, proper, is the most fascinating and delightful department of the art. Every live portraitist should have an outfit for such work, and use it for recreation and diversion and practice, if for nothing else. The general rules as to the manipulation of the plate, printing, and finishing, apply here just the same as in portraiture. And, indeed, the same lenses and

305. The lenses proper to employ for landscape pictures are both single and double; the first to be used when the subject is of that nature that some size is required, and that it will not suffer by a lengthened exposure; the best diameters are two and a half and five inches, covering respectively eight inches by six, twelve inches by ten, and sixteen inches by twelve; the aperture to be used will be better *reasonably* small, if the subject is well illuminated, since, under that condition, the extreme planes of distance will be more perfectly rendered. The triplet, especially, when refinement of treatment is desirable; Ross' wide-angle doublet, and Dallmeyer's wide-angle rectilinear, in *many situations* where it is necessary to take the subject at close quarters, and the double portrait combination where, at small sizes, a favorable opportunity is seen for quasi-instantaneous treatment of passing effects of chiaro-oscuro. Many very charming effects of aerial perspective, marking the different planes of distance, in undulating or mountainous country, are obtained by working towards the sun. This must be done when it is not too *near* the horizon, as then the light would look directly *into* the lens. Such treatment of the subject requires precaution to avoid fogging; it is well to shield the lens, whether single or double, by a dark cloth, which can be held above.—LAKE PRICE.

Opticians have been always ready as far as lies in their power to meet the wants of photographers, and great praise is due to them for the patient research and calculations to produce the splendid instruments now placed in the photographer's hands; still, it is just possible that, practically, we may have too much of a good thing, and overstep the mark in our eager desire to produce perfection. This was first seen in the early wish to obtain a perfectly-sharp focus, if only in one plane, but which has now given way to a desire of a more general and artistic effect by diffusion of focus in portraiture over the whole subject. The same thing, in a different way, has now taken place in consequence of a great demand for lenses giving rectilinear lines with wide-angles, which practically, as I hope soon to prove, are not

apparatus may be used, but, as explained in Lessons B and C, the best results are obtained outside by the use of such as are constructed purposely for this class of work. In the matter of lenses, the single, double, and triple combinations are all employed, and, to one doing much outdoor work, they are all necessary.

306. Here also the use of the diaphragm or "stop" must be well thought over as explained in Lesson C, and again the lens must be chosen

so good as those giving a slight amount of curvature, as in the old-fashioned single lenses, and which has been reduced to a good working minimum in the wide-angle single lens. To show this, set up two cameras—one with a rectilinear wide-angled, and the other with the wide-angled single lens, both having the same focus and angle. Place them before a square building occupying the best part of the largest plate the lenses will cover; level the cameras and cut off excess of foreground, and now examine the two pictures on the ground-glasses. The one with the rectilinear lens will be found to have a wedge-shaped image—that is, the top of the building will be wider than the lower part; whereas that by the single lens will be found to be exactly straight. This is what might have been expected; for if we measure the lines from the centre of the lens to the ground-glass opposite to it, and then from the lens to the top of the building, of course the latter is much the longer, which will account for the enlargement of the image. The single lens giving a barrel image will, under this circumstance, give a perfectly straight one. The only way to at all modify the picture by the rectilinear lens is to tilt the ground-glass of the camera. It is only when pushing the lenses to extremes that this will occur; but, as under any other circumstances the curvature of the improved single lenses is practically nothing, photographers will in general find them more truthful than any double rectilinear ones.—Francis G. Eliot.

306. Use the smallest stop possible under existing conditions. The circumstance limiting time usually is motion in the subject. Water in motion, swift-moving clouds, or atmospheric effects, must be taken instantaneously, or their chief beauty is lost. In such cases, detail must of necessity be sacrificed. Foliage in motion, trees swaying in the breeze, should never be attempted. If it is worth doing at all, it is worth doing well, and it pays to wait. Exposures on the quiet landscape, on rock and mountain scenery, or on architectural subjects, need be limited only by the necessities of your process and the time at your disposal. I have the Morrison, Ross, Zentmayer, and the "E. A." style of lenses for general use, working each as occasion requires. For landscape work, where straight lines are not essential, I prefer the simplest and cheapest of all—the single combination. I have taken passable marine views instantaneously with each. Under other less favorable conditions and subjects, I have secured good results with a fifteen minutes' exposure; ordinarily the time given varies from ten to sixty seconds.—S. R. Stoddard.

A photographer who owns a number of lenses and wants to determine which one to use for any particular view, may do so when visiting the spot beforehand without lenses or camera, and with very little trouble. We only require to know what size of plate each lens will cover, and its equivalent focus. The method of determining the equivalent focus of a combination is, in brief, this: Measure the distance of the focus of a distant object from any definite point on the mounting of the lens, and again from the same point with the lens reversed. One-half the sum of the two measurements will be very nearly the equivalent focal

to suit the subject and the angle of view required. There are rules for calculating these, and they are useful when it is really particular that a certain and given amount of subject must be included in a view. Generally, a look into the camera will soon satisfy the operator whether or not his picture, as a whole, is what he desires to secure.

307. There are other methods of satisfying yourself as to what amount

length. To find out what lens to use, take any small stick or twig and break it off equal to the horizontal width of the plate to be used, or the twig may be shaped to the outline of the plate. This is to be placed upon a rule, one end of which is pressed against the lower eyelid. Then move the twig along the rule until its ends cover the extreme portions of the view to be taken, and read off the number of inches, distance at which it must be placed from the eye, and this will be the focal length of the lens required. In case of having only one lens at disposal and we wish to find what sized plate must be used to include a certain view, provided it is in the capacity of the lens to cover, mark off from one end of a stick, by placing the thumb-nail upon it, a length that will include the view, at the same time holding the stick at a distance from the eye, measured along the rule, equal to the equivalent focal length of the lens to be used. In practice, a folding foot-rule in four parts is a convenient pocket size. To make this answer for a focal length, for instance of twenty inches, reduce everything to half-size, calling the focus ten inches, and when the size plate is found for a ten-inch focus, multiply by two to get the size actually required. Again, if, in case of stereo views, you expect that a lens of three or of two-and-a-half inches focus will be required, to avoid a chance of error that might occur from not being able to measure from the true centre of the eye, double or treble the length of the twig or stem of grass that you hold up to include the view, and you will then get accordingly two or three times the focal length to be determined with sufficient accuracy for practical purposes.—John M. Blake.

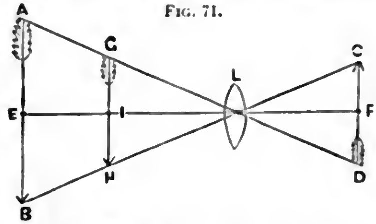
The following calculations have been made to show what angle of view is included in any picture when the *equivalent* focus of the lens by which it was taken is known. When the base-line of the picture measures the same as the equivalent focus of the lens, the angle of view will be fifty-three degrees. If it measures a quarter part more than the equivalent focus of the lens, the angle will be sixty-four degrees. If it measures half as much again as the equivalent focus of the lens, the angle will be seventy-four degrees. If three-quarter part more than the equivalent focus of the lens, the angle will be eighty-two degrees. If double the length of the equivalent focus of the lens, the angle will be ninety degrees.—T. Cuthbertson.

307. If the standpoint is not a given one, and it is desirable to have more or less of the view in the field, alter your distance from the object, until you find a suitable position for placing your camera. Again, the position, or distance, and size of plate are given, and you want to know the focal length of the lens necessary to give the required image: Place yourself at the given standpoint; hold the respective plate-holder before your eyes; move it to and fro until the plate-holder frames just what you want; measure the distance between the plate-holder and your eye; the distance is equal to the focal length of the lens required. Thus you are enabled to pick out the position to suit your taste and purpose. Frequently, view photographers are puzzled about the problems: How much of a view will my lens give at a given distance on a certain size plate? or, What distance is required for my lens to give

of subject you may expect to secure from any given standpoint. It is well to understand them all, for it will save many a climb. Inexperienced parties have been known to expend an hour or two in trying to

so and so much of a view on a given size plate? or further, if the distance is given, what is the focal length of the lens necessary to accomplish what I wish? All this, and for the thinking photographer a great deal more, may be answered by the following simple method, sufficiently accurate for all practical purposes. A B is an object in a horizontal position; L, the lens; C D, the image on the ground-glass; E L, the distance from the lens to the object; and F L, the focal length of the lens. It is easy to see, or at least to feel, that the given dimensions are in some relation to the proportions of the triangles A L B and C L D. Now, suppose you turn your camera around the lens L until the ground-glass, on which you previously traced the image with pencil, takes the position of G H; take off the lens, and put your eye where the lens was placed, and the image on the ground-glass will just cover the object

Fig. 71.



I L, then, will be equal to F L, which is the focal length of the lens. Consequently, we come to the conclusion: The image formed by a lens on the plate is precisely the same as the one which is seen by *one* eye through the plate-holder, or the glass plate itself, at a distance equal to the focal length of the lens from the same standpoint. Suppose you have a twelve-inch lens, and you want to take a view on a 10 x 12 plate: Hold your 10 x 12 frame twelve inches from your eye, and all that which you see through the frame with one eye your lens will produce on the plate, provided the angle of your lens is wide enough.—J. Zentmayer.

For further hints on apparatus and the lens subject, refer to Lessons B and C.

The annexed drawing represents one of the camera-boxes of the American Optical Company, known as the '76 Pocket 5 x 8 Dry-plate Camera-box. It is a model of lightness, compactness, general excellence, and perfect workmanship. It is supplied with one double dry-plate-holder, which is also very light. (Of course, additional holders may be had in any number.) It has also a movable central piece (to be inserted when used as a stereoscopic camera), a swing-back, a sliding front, and an attachment for using the camera vertically when the horizontal plate is not suitable for the subject in hand. Such an apparatus as this can be carried in one hand, and should accompany every photograph lover on every journey he makes. It is always ready for work, and is pretty certain in its results.

Fig. 72.

find a point of sight for the view which was in their mind to take. While they were knocking about, the light would lose its snap, the shadows lengthen, and the best possible opportunity for securing the view escape. Open the mind to learning and the voice of experience always.

308. In out-door manipulation there are certain modifications in the formulæ used which are essential. Of course everything works with greater rapidity than when employed in the glass studio, though this, too, is regulated by the nature of the subject, the objective used, the light, the diaphragm, and the time of day. Hard experience only can teach all the technicalities of this department; but, after all, the learning is so pleasant

308. So far as my experience has gone, the chemistry of out-door work does not differ materially from in-door work. I use precisely the same material as I do in my gallery, with such changes in compounding them as the nature of the object to be photographed requires. I generally use the simplest developer—iron and acetic acid, and only enough of the acid to make it flow evenly. Alcohol I never use in a developer, unless driven by necessity, and I always try to avoid the necessity by removing alcohol from my bath by evaporation, as often as it begins to annoy me. A few drops of alcohol in a developer may not be injurious, but I never could see any good results from it as long as the bath was in a good condition. I work as nearly as possible a neutral bath. Only a slight trace of acid is sufficient to keep the deep shadows from fogging. I use in my bath from forty to fifty-five grains of silver to the ounce.—J. C. Potter.

My landscape negative bath is as follows:

Nitrate of Silver,	4 ounces.
Distilled Water,	40 "

When the silver is all dissolved, add eight grains of iodide of potassium dissolved in one ounce of water; shake the whole well up and filter. In trying a plate, if there be any sign of fog, not from over-exposure, add one or two drops of C. P. nitric acid. After constant use a bath becomes saturated with excess of iodide, alcohol, ether, and organic matter. When in this state it is almost impossible to get anything like clear work. The quickest and best remedy, then, for rectifying the bath is boiling.—T. C. Roche.

The two collodions which I use for field work are as follows:

No. 1.—	Alcohol,	10 ounces.
	Ether,	8 "
	Iodide of Ammonium,	81 grains.
	Bromide of Cadmium,	35 "
	Cotton,	90 "
No. 2.—	Alcohol,	10 ounces.
	Ether,	10 "
	Iodide of Ammonium,	100 grains.
	Bromide of Potassium.	45 "
	Cotton,	120 "

No. 1 is a light collodion, working fine detail, but not great intensity. No. 2 is a heavy collodion, working less detail and quite intense. Combining the two properly gives you

that no one need despair. The bath, collodion, and developer being all right, your effects should be so.

309. The nicest development is required in landscape work, and in accomplishing it the time of exposure should be kept constantly in mind; and not only this, the nature of the subject should be remembered. One great difficulty with landscape work, particularly, is to preserve the delicacy of the white parts without rendering the contrast with the darks too strong and harsh. As a usual thing, it is wiser to expose fully enough for the details in the darker parts, and let the rest be managed the best way possible, but if, as in case of clouds or a waterfall, the light parts are the most important—expose to suit them.

almost any result you may desire. Good judgment and careful manipulation should make you master of the field.—J. C. Potter.

For out-door collodion, I use

Alcohol,	½ ounce.
Ether,	½ "
Iodide of Ammonium,	2½ grains.
Iodide of Cadmium,	2½ "
Bromide of Cadmium,	2½ "
Gun-cotton,	5–6 "

This collodion keeps well, and is good for view and portrait work. If it should become too pale by long keeping, which it will do when the gun-cotton has been washed in diluted aqua ammonia, tint it with a solution of iodine in alcohol.—John L. Gihon.

309. My developer for field work is—

Double Sulphate of Iron and Ammonia,	4 ounces.
Water,	64 to 70 ounces.
Yellow Rock-candy,	3 to 4 "
Acetic Acid, No. 8,	5 to 6 "

If the silver bath has been in use long, the addition of one ounce of alcohol to the above developer will cause the solution to flow more freely. As a general rule, this developer reduces the time for dark details at least one-third; for studio work this developer is too strong, and should be reduced with water to suit the light.—T. C. Roche.

Developer for out-door negatives.—

Glacial Acetic Acid,	1 ounce.
Water,	16 ounces.
Protosulphate of Iron, to the ounce of solution,	15 to 30 grains.

The proportions have to be varied so much according to circumstances, that it is impossible to give them exactly. With a little practice one soon learns to regulate the strength of the iron and acid to suit the work in hand. In warm weather the developer can be diluted just before using; consequently, one can carry as much in one bottle as when diluted will make two.—John L. Gihon.

Carry development as far as possible. If trouble ensues, seek the remedy elsewhere

310. If it is desirable to develop the plates in the field, and it is the most certain and safe way, then a dark-tent must be employed. If the plate is kept too long before exposure, it will become stained. Again, a very common trouble lies in the bath solution not remaining evenly distributed over the exposed plate, but collecting in streaks or drops of oily appearance, and tending to unequal and defective development. This tendency is due to the collodion giving a film too horny and too repellant of aqueous solutions. It may arise from too much ether in the collodion,

There should be no conditions to make this last rule objectionable. Great stress has been laid on the rare good judgment which should carry development to just the proper point and then check it. In my practice, the proper time to stop is when the iron ceases to act on the negative, and no sooner.—S. R. Stoddard.

I never fix my negatives until I return to my gallery. After developing and rinsing I flow them with glycerin and water mixed, about half and half, or enough water to make the glycerin flow evenly. There is not the slightest danger of their spoiling if they are not fixed for one week after. A good rinsing before fixing is all that is necessary. Redevelopment may be resorted to, or intensifying, as may be necessary.—J. C. Potter.

It has often happened in my practice, and no doubt in that of others, that the distant hills, indications of clouds, a stream of water, or a waterfall in a landscape, or a gentleman's white tie, the folds of a lady's dress, etc., are distinctly seen when the negative is first developed with the iron developer, but on redevelopment are lost, and become one unsightly patch of white in the print. This may be avoided in a great measure by the following plan. When the details are well out with the iron solution, clear with cyanide, well wash the plate, and allow it to dry; then take a camel's-hair pencil, paint over the light to be preserved with

Gum Dammar,	30 grains.
Benzole,	1 ounce.

This will dry instantly. Then proceed to redevelop the negative with pyro and silver in the usual way, previously using a dilute iodine solution. The pyro and silver will now only act upon the non-protected parts of the negative. Care must be taken to keep within the limits of boundary given by the lens, which is not a difficult matter, as the solution is easy to apply.—Thomas Gulliver.

310. I accoutre myself as follows:

Tent.—A very light tripod covered with two thicknesses of black calico, and one inner one of yellow. The calico is about twelve inches longer than the tripod, and when the legs are extended, I place a few stones upon this extra cloth, all around the inside of the tent, to steady it and keep out light. The cloth is also wider than required to cover the extended tripod, and, when I sit down inside, either upon my plate-box or on my heels, my assistant brings the cloth around me, overlaps it at one side, and keeps it there during development, etc. I find this tent the handiest for most subjects that ever I tried. When not in use the cloth is folded around the tripod, and the tent is then placed inside of the camera-tripod, and fixed with one leather strap and buckle. These (the tent and the camera-tripod) form one parcel of about ten pounds' weight, which I have often carried in my hand two or three miles at a stretch. For country work, however, there can be nothing better or more easily

in which case alcohol may be added, but more frequently the pyroxylin is in fault. With different operators, the time during which the plates may be kept out of the bath before use, varies extremely; it is a common complaint by operators that they cannot keep their plates more than a few minutes, whilst others keep them from a quarter of an hour to an hour and more. As the trouble arises from a repulsion between the film and the bath solution, it is evident that we must try to bring them nearer to each other in properties.

set up, and, if one takes care to dampen it inside occasionally, I believe negatives more free from pinholes can be done in it than in any developing-box, and it is twice as portable.

Camera.—I have latterly used a sliding bellows-body camera, which takes plates seven by four and three-quarters, with two sliding fronts: one for single lenses when taking negatives the full size of the plate, and one for a pair of stereoscopic lenses, the flanges of the latter made to fit a half-a-dozen different sized lenses, by means of which are fitted on all the lenses except the largest pair. The box closes up to two and a half inches, and draws out to eight and a half, and it can be turned on end when taking upright views. It has also a removable centre division, which can be taken out when full-sized plates are used.

Lenses.—The lenses consist of a triple and a single lens, each of eight inches focus; and stereoscopic, single and double, of six inches, four and a half inches, seven and a half inches, and two and a half inches focus. These I carry in leather cases, slung on a leather belt worn over the shoulder like a shot-belt.

Chemicals.—All my chemicals are put in sixteen-ounce bottles, and packed in baskets made for the purpose: a large one for carrying a stock, and a small one for holding sufficient for a day's work. The latter, when filled, contains three sixteen-ounce bottles of sensitizing bath, one of developer, the glass bath and dipper in a wooded case, eight two-ounce bottles of collodion, three two-ounce bottles of glacial acetic acid, one six-ounce bottle of cyanide solution, one dripping-bottle, one six-ounce bottle of crystals of sulphate of iron, one two-ounce bottle of crystals of cyanide, and a small glass funnel, one gutta-percha funnel, a plate-holder, a small portfolio holding filtering-paper, a dusting-brush, chamois leather, and two towels. All these go into a handy basket, which my assistant easily straps on his back, so that when we start to the field or mountain, I have the tent and camera-stand in one hand, my plate-box, containing twenty-four plates, in the other, with the lenses, in their cases over my shoulder.—George Washington Wilson.

It frequently happens during the hot summer months that we have to go out to take monuments, and sick or debilitated people, but find in such places no means of developing. Such has been my experience this summer, which led me to make some experiments in order to keep the collodion moist. I tried several means and ways to no purpose, until I tried the following: Pure glycerin, one ounce; condensed water, half an ounce; shake well, and after the plate is coated, drain, and wash with clean soft water until the greasy lines are nearly all gone; then pour over it the glycerin on and off, till all the lines are gone. Let it drain for a time, and place it in the shield. It will keep moist for three or four hours, with the thermometer at 104°; the time required is from fifteen to thirty seconds, according to light and stop used in the lens. I develop with iron, rather weak at first, twelve grains to the ounce; I use glacial acetic acid, two to twenty-four ounces, until it penetrates the

311. There are still other methods of preserving the plate for a long time between the time of coating and developing it. One of the best consists in the addition of a few drops of water to the collodion. The method employed in such cases is as follows: A good ripe collodion should be used, and new strictly avoided; to this, drop by drop, distilled water is added, equivalent to about two drops to each ounce of collodion; after the addition of each two or three drops, the collodion is well shaken, lest the precipitation of the cotton should occur; after this, carefully filter. There is much in the manner of adding the water, by small de-

film; then I add silver, five grains to the ounce, pour it over the plate, when, to my delight, the picture comes out boldly and clearly. In order to get up intensity, add more iron and silver, after which treat it as usual with negatives. Any mode of developing generally practised will do, with the addition of silver; but without it, there is only a faint outline of a picture. I have never seen this recommended in any of the journals, but hope it will be fully tested by more skilled hands.—B. S. Cooper.

Every photographer is familiar with the risks of stains from partial drying of the plate, when a long time elapses between exciting and developing the plate. Here is a method the extreme simplicity of which will entitle it at least to a trial, and one trial will prove its utility. The plan is simply to flood the plate with a few drachms of distilled water previous to exposure, the water is then poured from the plate to a developing-glass, and must on no account be thrown away, for in this appears to lie the secret of success. After exposure, the plate is again flooded with the same water that was previously used, and which, after thoroughly moistening the film, is again returned to the developing-glass, and mixed with the required quantity of developer, and the development proceeded with as usual. Plates so treated will give pictures as clear and free from markings as if only exposed in the camera for a few seconds.—John L. Gihon.

311. In my own practice I have always been able to avoid this inconvenience by redipping the plate in the bath just before development, and I recommend this course as a cure for the evil. The quality of the pyroxylin has much to do with this, as also the salts with which the collodion is bromo-iodized; and it is a noticeable fact that in the bromide process with the bath this evil is much less in plates kept very long than in the ordinary bromo-iodide process.—Col. Stuart Wortley.

Some of our best landscape photographers have been for some time developing in the field, and finishing up at home in the evening or next morning. The mode is as follows: After developing the plate, wash off with water; then flow over a solution of glycerin—

Water,	4 or 5 ounces.
Glycerin,	1 ounce.
Alcohol,	½ "

Or you can dispense with water in washing off the iron, and flow on a solution of—

Glycerin,	1 ounce.
Water,	4 ounces.
Acetic Acid,	1 ounce.

Flow on like collodion and drain; then flow on a second time, and put the plate in the negative-box. In this way you lose no time in finishing up, but can keep on taking nega-

grees, and carefully shaking after each addition. Plates coated with collodion so modified will keep free from stains three hours in a moderately dry temperature.

312. Sometimes it is necessary, too, to keep the plates a long time after exposure before they can be developed and fixed; and, again, when they have been thus kept, after-manipulation is required in order to bring them up to a proper printing quality. All these little niceties must be studied. In no branch of the art is the exercise of careful thought more essential than in this, provided you are not content with indifferent results.

313. As to interior work, *i.e.*, views of the interiors of churches, dwellings, factories, and what not, the manipulations are largely the same as

tives. Plates with glycerin on them will keep a week or more with safety. When you reach home, wash off the glycerin, and fix in weak cyanide; then force up, if required, by any of the well-known methods.—T. C. Roche.

312. I prefer, after fixing and washing, to flow over the plate a solution of

Acetic Acid, No. 8,	½ ounce.
Water,	5 ounces.

I then drain and flow over a solution of pyrogallic acid, No. 1, mixed with a few drops of acid silver, as per formula No. 2.

1.—Pyro,	60 grains.
Water,	20 ounces.
Citric Acid,	20 grains.
2.—Silver,	20 grains.
Citric Acid,	10 "
Water,	1 ounce.

This will bring the negative up to a good printing color, which will not change. Dry and varnish the negative. Keep the shield and camera free from dust in working, and take a general interest in your apparatus.—T. C. Roche.

Take iodine one drachm, iodide of potassium one drachm; dissolve in twenty ounces of distilled water. This forms a stock solution of the color of good old port, and for use may be diluted six times. When the plate has been developed and washed as usual, flood it with this dilute fluid, and keep it on about half a minute; then wash again, and put in the draining-box. The plates may be intensified at any time; but I prefer, on getting home, to let them dry in daylight on a rack, and if any further intensity is required (though this is not often the case), it is done either with iron and citric acid or pyrogallic and citric in daylight, and fixed as usual. I can scarcely give too much prominence to the importance of this matter.—Samuel Fry.

313. Sometimes it is necessary to take a view of an interior or of some object at a distance from the dark-room; in either case, when as much as two hours must elapse between the plate leaving the bath and its development, the only extra precautions to be observed are, collodion quite ripe, and if inclined to give stains, the addition of a little water, say one drop to the ounce, will cure it. Bath proper strength, free from organic matter, and rather acid. Allow the collodion to set well before putting the plate into the bath, and when in keep it

the others, only the exposure must be very much lengthened, when one or the other of these hints as to the preservation of the plate will be found of use. The collodion may be modified to suit the lighting of the subject, and, as a rule, a weaker developer is used. In these times the wet plate is seldom used for interior work. See the lesson following.

moving the whole time, and *directly* the greasiness has disappeared, drain, and put it into the slide, with a piece of wet yellow calico behind it. If it is an interior that is taken on this plate, the developer will range from medium to strong, as it happens to be well or badly lit; if it is an out-door view away from the tent that has necessitated the plate being kept, a developer from medium to weak will be required. I find, as a rule in this case, that a less exposure and a weaker developer are required than if the tent had been on the spot, and the plate been kept ten minutes instead of two hours.—John L. Gihon.

These two items (hot water and sugar) to the landscape photographer are of great importance. By the first distilled water is superseded in the making up of baths, and a more perfect solution of silver is obtained, with a thorough elimination of organic matter. In the case of the developer a greater saturation of iron, and, if to it be added a small proportion of white crystallized sugar, will not only make it keep almost indefinitely, but will impart to it such qualities as to make it a pleasure to work with. Besides creating a saving of alcohol and acetic acid, it equalizes the action of the iron on the film, restraining the development, and rendering over-exposure a matter of rare occurrence.—W. Harding Warner.

My collodion formula for making interior views is

Alcohol,	11 ounces.
Ether,	5 "
Iodide of Sodium,	48 grains.
Iodide of Ammonium,	48 "
Bromide of Sodium,	48 "
Chloride of Magnesium,	48 "

Cotton, 1½ grains more to the ounce than for portrait collodion.

Pure Spirits of Wood Naphtha, ½ ounce to 16 ounces of collodion.

By using the above collodion, a negative can be exposed for thirty minutes, without any of the usual defects which are caused by a long exposure.—Old Argentum.

When we arrive at a point where we intend to work, I immediately unstrap the tent and set it up, whilst my assistant collects a few stones to keep it steady; and whilst I am arranging my bath and chemicals in the tent, my assistant runs to fill his cans with water at the nearest source. By the time he returns I am ready to coat a plate (which I always do inside the tent), and, as the plate is getting ready, I place my camera ready to receive it. If it is a subject we are attempting which can be taken instantaneously, I use my six-inch focus lenses with a five-eighth inch stop, and expose by removing and replacing the cap of the lens as quickly as possible; but if it is a subject requiring a long exposure, I make a guess for the first plate, and, from long habit, generally succeed in hitting it pretty exactly. In spring, the actinic property of light appears to be very active, and it is only then that I have succeeded in getting passable instantaneous pictures. Early in the season views of buildings may be taken with a small stop in from two to ten seconds, and landscapes with trees in from five to fifteen seconds; but by the month of August and September I find

814. A knowledge of the principles of art is quite as essential to the photographer outside of the studio as to the one who makes portraits only, and therefore much of the instruction given in Lesson A will be found useful when prosecuting this delightful branch of photography. For the education of the eye, the balancing of the lines, contrast, choice of position, composition, light and shade, and all such essentials, are quite

from thirty to sixty-six seconds are required for most landscape views, and instantaneous exposures are of no use except for clouds and water. The plate being exposed, I get myself shut up in the tent, and develop in the usual way, by dashing on the solution as quickly as possible, and moving about the plate to prevent stains. If it is an instantaneous view, all the details should come up slowly and distinctly; but I keep on moving the plates for two or three minutes, so as to get all that I can up before washing off the developer. This I do carefully and slowly, and as the negative in this stage is very thin in deposit, I pour from my dropping-bottle a small stream of nitrate of silver along the side of the plate, and let it flow over the whole surface before dashing on a fresh dose of developing solution, keeping the plate moving as usual. When this has acted for a minute or so I wash it off again very carefully, and repeat the process sometimes three or four times, if necessary, until the requisite printing density is attained; then, after a slight washing, I bring it outside the tent, wash thoroughly, and fix with cyanide of potassium. If the plate has a long exposure with a small stop, I find one redevelopment generally enough; but if the plate looks too thin after fixing, I sometimes take it into the tent and redevelop a second time. The cyanide, however, must be well washed off, otherwise there is danger of getting a reddish deposit upon the shadows.—George Washington Wilson.

Never study economy in lenses, apparatus, etc. Never attempt any subject if the light be not suitable, as, however good the picture (or rather, I should say, the negative) may appear, it always disappoints one afterwards. Never focus carelessly. Very much depends on this. As a rule, it is a good plan to focus some central object in the view. For interiors especially this is a most important matter, and sometimes difficult. It is a good dodge to fasten up some large type—the heading of a newspaper, for instance—in a central position. This gives one a good chance of getting a sharp picture. Never use any but the best patent plate, which, by-the-by, do not clean with anything but alcohol, as tripoli, etc., only adds another evil to the bath. Never waste time in doctoring an old bath. Make a new one, and this as simply as possible, thirty-five grains of silver to each ounce of water; add a little old collodion, filter, and it is ready for immediate use. (I have always found that the ordinary nitrate of silver answers every purpose.) Never, after securing one good negative, leave the ground till you have tried for a duplicate, which is often better. The greatest secret in the negative process, to my mind, is a properly-timed exposure; herein lies the great art of photography, and makes a difference between a picture and a photograph. If you are required to drag out your child, he only looks sullen when he appears.—Frank M. Good.

314. When you come down to real, legitimate landscape work, then you must *study*. There is always a time of day when the light is better on any subject than another, and this you should make your particular study. If of a chain of mountains, carefully regard the time when the shadows so fall as to give you the best outlines and the best effects in the val

as important in their place in the one as in the other. Out of doors y. u meet your chief helper, light, on its own ground, and there you may study its nature and learn to manage it to much better advantage than when in the studio. Again, with art principles instilled within the mind, there is constant opportunity out of doors to practise them, and to compare nature with their teachings. Be assured, there is as much in composing a landscape as there is in managing a composition under the sky-light; yea, even more, and often the landscape photographer must *wait* patiently until the light falls to suit him; for he has no curtain nor screen to direct at his will.

315. The photographer entering the field must first choose his subject, and his knowledge of art principles will now come in to help him select and arrange and combine in a picture the material which he has at hand, so as to produce the most agreeable result, and to tell the story. To secure a picture of a lake, it must not be taken from the narrowest end where a bridge crosses it, and, filling up the foreground, hides the beautiful water and all chances at reflections. That would be a picture of a bridge and not of the lake. All through, harmony and unity and balance of the lines, with light and shade, are the chief things to be looked after. Once upon the ground, you begin to *combine* one part with the other. A vast expanse of beauty is spread out before you, and invites you to make

leys; if of a woodside or a grove, perhaps a little lake or pond, near at hand, may secure you some lovely reflections; if of the pebbly beach, some shattered spars or broken pieces of a wreck may add interest to your foreground, or a coil of cast-off rope be made to cover the ugliness of a heap of sea-weed. Again, if you are striving to snap up all the possible detail in a noisy, saucy waterfall, if the fluttering branches of a tree are in danger of spoiling your foreground, consider no labor too great to cut them out of the way. I have spent an hour in this kind of work, cutting away bushes and limbs until I had taken the wind right by the horns, and completely disabled it from doing me harm. More than that, I was with a good friend the other day who climbed nearly thirty feet up a nasty, rough cedar tree, holding on by his teeth, claws, and toe-nails, hatchet in hand, chopping away at the tough limbs until his dear cascade was unobstructed. Not only that, he drove seventy miles in his wagon to get the view, and seventy miles back. Now all such as these I call escapes—escapes from making bad pictures.—George W. Wallace.

315. Select the view you desire to picture, and study it under all the effects of light, shade, and shadow, from "early dawn till dewy eve." Photographs taken each hour through the day, without changing the position of the camera, will produce quite a variety of effects, some of them appearing as unlike others as though they were of different views. By studying nature closely under all her phases, you will shortly learn, when looking upon a scene at any time of day (by simply consulting your pocket-compass), just the proper hour to visit the place with your camera in order to obtain the best possible effect.—James Mullen.

free and help yourself. But you are a photographer, and you know the capacity of your art is limited. You must therefore practise self-denial, and take only what photography will give you, and what it will secure for you well. And this thought brings to mind the size and extent of the view to be taken.

316. The size of the picture is somewhat a matter of choice, and yet it has much to do with the general effect. The 5 x 8 inches and the 8 x 10 inches are perhaps the most popular and advantageous sizes as to glass, when other than stereoscopic pictures are to be made. As to the amount of subject to be chosen, that, too, is a matter governed by choice and circumstance. Views including a vast amount of subject are never so attractive, *as pictures*, as those made of the richest "bits" at a less distance from the camera. A short view is generally the most satisfactory, too, because the objects are larger, and the lighting may be managed with more ease and satisfaction.

317. The point of sight from which to make the picture must be regu-

316. The size of the glass must necessarily decide in a great measure the expense and weight of the outfit, as a large plate requires a large camera-box, lens, and every other article in proportion; whereas a small plate reduces immensely both these items. I would advise either a glass of 6½ x 8½, or 5 x 8 inches; each size has some advantages over the other. For example, should stereoscopic work be the principal object, then preference may be given to the 5 x 8 size; under most conditions this plate is very useful. By using one lens only a picture can be made over the whole plate, of pleasing proportions, when the length of the glass is placed horizontally; if placed upright in the camera, or the box turned on its end, the picture will be too narrow for its length; but as by far the greater proportion of pictures are made with the length of the glass horizontal, this defect is of less importance. The advantages of the 6½ x 8½ glass are: The single picture is somewhat larger; the position of the glass plate in the camera can be either lengthwise or perpendicular without injuring the proportions of the picture. Stereoscopic work is admissible, but at a waste of glass and chemicals. A frame or *kit* can, however, be readily fitted into the dark-holder to take a 5 x 8 plate, so that for general landscape photography I would advise either of the above-mentioned sizes.—J. C. Browne.

As a general thing, there is much more interest in a short view than there is in a long one, which comprehends a large amount of territory. There may be instances where "distance lends enchantment to the view," but it is seldom the case in landscape photography. Mountain scenery may be an exception.—J. C. Potter.

317. We will suppose you intend taking a photograph of a street. Select some important object for a foreground, place your camera about six feet from the opposite side to your principal object, including in your picture a portion of the building on the same side of the street on which you have fixed your camera. You have then made the most of your principal object, the perspective gradually merging more to one end of the plate than the other, and securing a pleasing composition. Observe a similar arrangement in river scenes, old lanes,

lated somewhat by circumstances, but sometimes circumstances may be made to bend to your will, and give you a choice. Diagonal composition and aerial perspective (see Lesson A) now come in to your aid, and must be duly regarded and allowed to influence you in your choice, be your subject in hand a street view, or amidst the rocks and rills and the sunny hills.

318. Having decided pretty nearly where to place the camera, you now begin to arrange your composition, so to speak. The novice will have to shift to the right, to the left, go higher or lower, until he knows full well what he may exact from his lens, or how he stands as to the matter of light and shade and perspective. But all this is good, refining, and cultivating. A dozen and one things will occur to perplex him, but his art principles will always offer a helping hand if he will only be led by them, especially in arranging his composition. Never be satisfied with "good enough." Expend your ambition, rather, on trying to secure a single first-class view than on obtaining a dozen indifferent ones. It will *pay* the best in the end, both in experience and in money.

etc.; indeed, the same simple arrangement applies to many classes of subjects. After a few trials, the novice will be able to select for his picture a good point of view. If the subject be only a trunk of an old tree, an isolated rock, spire, or tower of a church, always arrange it more to one side than the other of your plate. It must be understood that there are numerous subjects that no fixed rule would be applicable to; in such the operator would have to rely on his own judgment to arrange his picture; but careful study will soon make difficult pictures as easy to arrange as the most simple. It is desirable to avoid small stops, and not attempt sharp, hard pictures. I work with as large an opening as the subject will admit, taking care to get, if possible, a soft negative with a very brief exposure; long exposures, with small stops, produce flat, tame negatives, without relief.—REUBEN MITCHELL.

318. We must generally take Nature as we find her. Recently, I made a few negatives in a romantic part of the country within a hundred miles of our city. How often the lines of the picture were perfect, the foreground everything desirable, but Nature was in the sulks; she would not smile—no sun shone. Then, again, everything seemed in good humor; the sun shone, but a wind was blowing great guns. Another time wind and weather were favorable, but the foreground was bad—a great bank of sand hiding a choice piece of middle distance. Yet, determined to succeed, I changed point, and carried boulders and mossy logs to make a presentable foreground, when a dense smoke from bush fires settled down and spoiled everything. I waited around for eight days, but had to leave without my picture. Had I the ability to paint my subject, from one point I could get the middle-distance and upper part of the picture. I would then have stepped a few feet to the left and obtained a fine tree for foreground, and then returning a few feet to the right, I would have had some rocks, beautifully marked, to form a strong point in the foreground, also, making my gem complete.—W. J. TOPLEY.

319. To what has been said in Lesson A on aerial perspective and the balancing of the lines, reference must now be had again, and comparison made with the model view here given, "On the Shores of the River Neuse," by Jan Van Goyen. It seems to possess nearly all the elements laid down for a good landscape in the rules, for the artist has conformed strictly to the customs of art. You can see how his picture gains in value by such a course, if you but exercise the imagination a little bit. Take from it, then, the groups in the foreground and heap of old piles and bits of grass, and see what a destruction of the beauty of the composition will occur. You not only thus destroy the effect of perspective, but you deprive the picture of the perfect balance which it possesses, and the repetition of lines which occurs in the foreground of those in the distance. Again, the lines in the distance would appear to want collecting together and regulating; the distance would come forward, so to speak,

FIG. 73.

319. One who truly loves and studies nature, sees constantly beautiful pictures on every side whilst travelling over the country. It does not always require a grand scene of rocks, river, and mountain to make up a picture. Very simple things, which a person not accustomed to observe would pass by unnoticed, will, in the hands of one who has the knowledge and tact to properly picture them, be made very attractive and artistic too. Small bits of landscape I would advise as preferable for the beginner as being more simple, and a variety of composition and effect can be produced with greater ease and simpler means. The foreground being one of the main points in the picture, and generally required to be bold and effective, can, if not naturally so, be made so in a great measure by a little labor in the way of rolling up an old log or stump in an effective position, or placing a bush or clump of large-leaved weeds where they will be of service in making a proper balance or contrast as may be needed. And let me advise you here to always have with you, on your photographic trips, a spade and a good axe; the latter particularly will often be found "a friend in need," when it is desirable to cut a small tree or remove a branch that would otherwise obscure some important point of your view.—JAMES MULLEN.

into the foreground, and the parts would not assume their proper relation to each other. The buildings on the left and right would seem to topple into the water, and the sails seem to be speeding over some empty space or precipice. Again, remove all the objects in the distance, and see where your perspective would be; and consider, too, what a miserable picture you would then have, with nothing but a black mass in your foreground, against a shimmering, unending sea of light.

320. And after all these points are looked after comes the all-important subject of light. Upon it depends *all*. It not only secures the brilliancy of the picture, but it even changes the forms and sizes, seemingly, of the objects included in the view. It lengthens and shortens the shadows, it gives the contrasts of light and shade, it gives the detail where wanted, and all the snap and life there is to the whole composition is regulated by the light. In every picture there are points which are more

320. Brilliancy in a photograph is a mere matter of intensity altogether irrespective of any artistic consideration. It alters neither form nor composition; but sunshine not only supplies this intensity, but especially improves the picture by varying the forms. In illustration of this, take a foreground with nothing but a grass bank and short herbage growing upon it; the advocates of no sunlight represent it as a blank and even patch, which it possibly may be, but, give sunshine a chance, and the shadows of neighboring trees, etc., or inequalities in a ground itself, make a broken and pleasant effect without an accessory of any kind. What applies here to the small piece of foreground holds good with the whole of the landscape, and I firmly believe that no landscape was ever taken on a sunless day, no matter how successfully, but would, with the same skill of manipulation, have been infinitely better done on a sunny one. In fact, it is a mystery to me how any one who has intelligently studied landscape effect at all could think otherwise. Because there is sunlight, there is no necessity for chalkiness or snowy effect in the foliage, or want of detail in the shadows. These effects are mere errors of manipulation, and chiefly occur when the plate has had insufficient exposure or faulty development, and are not due to the lighting of the subject.—Edward Dunmore.

The student should note distinctly that, however astonishing and captivating good definition and detail may be in studies of foreground, etc., in the general landscape, fine broad effects of light and shade will supersede all. Mere clean mechanism on the plate grows monotonous, and will always succumb to the sentiment conveyed to the mind of the spectator by representations, photographically less perfect, in which any of the changing effects of light and shade may have been successfully rendered. The artist should likewise consider that careful and discriminating selection will make itself felt in this as in every other description of subject, and must not go out with his camera as to a sort of photographic battle, in which one well-studied picture seems not to be the desideratum, but *quantity* not *quality* is sought for. Now, the truth is, that one little bit of well-selected foreground, a bank with a few docks and thistles, with the bright sun-ray glancing from the tufted grass to the ivy-grown stump of the gnarled pollard, is worth a hecatomb of such things.—Lake Price.

prominent than the others, and to which all parts are made more or less subordinate. By a careful arrangement of the lights and masses of light and shade, we secure the prominence due to each object. This is plainly exemplified in the model picture given.

321. Sometimes figures are introduced with good effect into the picture, but they are not advantageous unless used to make up the story, when they must be posed and placed so as to harmonize with all the other parts, in other words, *be* one of the arts of the whole. There are times when they will give life and snap to a picture, but never allow a policeman to intrude for such a purpose. In street views figures are allowable. In the landscapes, only where they can be used to help give the idea of height or distance, or to harmonize in some way subordinately with the rest of the subject.

322. As to the matter of exposure, there can be no rule,—the time of day, the condition of the light and the atmosphere, the nature of the subject, the wind, and what not, regulating this matter largely. Always

321. Do not introduce figures into your picture unless they can be made to appear a part of the same, or to belong to the scene. Many a photograph that would have been faultless otherwise, is totally destroyed by the indiscriminate introduction of one or more figures which are entirely out of harmony with the scene, and only mar it.—James Mullen.

If it is desired to produce works of a more artistic character, in which various masses of buildings, at different planes of distance are introduced, *less dimensions* must be attempted. In some such subjects, as for instance, views of Florence looking down the Arno, of Paris from the Seine, etc.; the want of figures in the picture is not so much felt as when the squares and streets of populous cities are represented; here, if anything approaching the appearance of the originals is to be shown, it can only be by combining in the picture the moving panorama, and not giving a Pompeian aspect to the most crowded and busy thoroughfares. For the first, single or stopped-down double lenses may be employed indifferently; the resulting pictures will be distinguished by the less size and greater definition in those taken with double lenses; for the second double lenses can alone be used. The operator must avoid *large masses* of shadow, and if skill is shown, pictures of ten by eight inches may be thus obtained, not but that very considerable difficulties must be contended with and overcome; but if *a picture* of this class of subjects is to be presented to the spectator which shall impress him with the aspect of the original, as seen in nature, it is to this treatment alone we must look for success.—Lake Price.

322. Time for perfect detail in the shadows; the high-lights will, or ought to, take care of themselves. If they do not, if the resulting photograph gives the middle- and high-lights as one chalky mass of intensity, it is an indication that your chemicals have a radical fault which must be remedied. Your bath is too strong, your collodion too thick or not properly iodized, or some one of the many faults exist which no amount of skill in undertiming or developing can correct. Do not be satisfied with this sort of snow-flake effect. It is certain that, with the simplest of lenses properly stopped down, sufficient exposure, and full develop-

secure enough, and if the wind attempts to blow, quickly close the exposure, wait until it is over its unmannerly freak, and then expose again. Often the foreground needs more time than the distance. Regulate this by a hinged flap or shutter on the front of your camera, by means of which the lens may be shaded at will to suit all circumstances.

323. The addition of clouds to a landscape cannot be too highly valued, but, alas! photography is too often unable to secure them with the average

ment, perfect and complete gradations of tone, leading from deep shadow up to pure white in the sunshine, can be caught, provided both collodion and developer are in harmonious working order.—S. R. STODDARD.

323. All clouds can be photographed, from the lowering rain-cloud up to the sunny regions of the cirrus, those multitudinous and apparently motionless lines of delicate vapor with which the blue of the open sky is commonly streaked and speckled after some days of fine weather; but those most strongly marked in outline, and having the most favorable contrast of light and shade, are the easiest to secure on the plate prepared by the ordinarily used collodion process. The collodion should be very ripe, that is, it should have been iodized for many months, or, if newly iodized collodion only is obtainable, sufficient tincture of iodine should be added to it to make it a golden sherry color. The iron developer should be weak; about eight or ten grains to the ounce of water would be a suitable strength, with a corresponding amount of acetic acid and alcohol. The plate should be new, and very clean. Spots and stains are fatal to skies.

Any lens will do, but if a portrait or any quick one is employed, it should be stopped down. The difficulty in taking skies is to avoid excess of light, and to expose quick enough to prevent the plate fogging all over. The method of proceeding is as follows. Prepare and excite the plate in the usual manner. Expose, for a bright sky, as small a fraction of a second as you can manage with the ordinary cap of the lens. Carry the slide to the dark-room, and develop. It is in the developing that the most judgment is required. In a matter so delicate as the guessed exposure of a fraction of a second, in which one exposure may be double that of another without the difference being noticed, a great deal must be regulated in the development. Remember that the darkest parts of the clouds should be represented by bare glass in the negative, therefore, after the developer has been thrown on, and the high-lights and succeeding gradations, almost down to the darkest, have come out, pour a flood of water over the plate, and wash thoroughly. The negative must now be treated with a solution of iodine in iodide of potassium and water, made thus water, ten ounces; iodide of potassium, five grains; tincture of iodine, sufficient to produce a pale sherry color. This is poured over the plate, and washed off again. The intensification must now be commenced with pyrogallic acid, and will be found, if the clouds are delicate or feebly lighted, to be an operation requiring much patience. When the pyro becomes discolored, it should be washed off, and another dose of the iodine applied, after which fresh pyro again, and so on alternately until the requisite intensity is attained.—H. P. ROBINSON.

It is generally known by photographers that there are different methods of producing cloud effects by which satisfactory results may be obtained. Negatives taken from natural

subject. By reference to the model picture, their value will be seen. They may be secured separately and printed in oftentimes, with admirable effect. As a usual thing, they are too rapidly moving to be secured with any detail, for while the foreground was being exposed, they would be over-timed and entirely lost. Sometimes, however, this is not so. They must be treated much as children have to be in portraiture, and taken when they are in a quiet humor. Reflections in water are always attractive in a view. The water should be perfectly still, and the light brilliant. The finest reflections occur when the atmosphere is foggy, but

clouds, if tastefully selected and printed with care, add greatly to the picturesque and artistic finish of landscape pictures. It may happen at times, that out of a whole batch of cloud negatives there is not one suitable for a particular picture which has to be completed. I have for some years past practised a method of producing cloud effects which has with me proved very successful, yielding proofs of a most delicate and refined character, giving great relief, yet in which there is nothing harsh to attract the eye from the subject, being very softly blended, and producing a most charming effect in the landscape picture. Procure a sheet of finely-ground glass the size of the negative, and, having previously printed a rough copy of the landscape, place it under the ground-glass laid upon a table, with the rough side of the glass upwards. It will then be observed that the picture is quite visible, thus offering every opportunity of arranging the clouds in any shape or form so as to harmonize with the subject. Now proceed to lay in the clouds with finely-ground black-lead powder, with the aid of a small sable brush, rubbing in those parts requiring to be most opaque with a small piece of India-rubber, afterwards tracing around the upper edges of cloud-masses with a lead-pencil, and gradually softening off the lower portions with the rubber. Take particular care to keep the whole nearly transparent. A little skill combined with taste is necessary to accomplish this with neatness, but it will be found after a little experience that some most excellent resemblances of clouds can be produced. It is advisable to make the sky portion of the negative quite opaque, so that the prints will remain perfectly white in the protected parts, which are to be printed under the cloud-glass. The easiest and quickest way to accomplish this is by blocking out upon the reverse side with black varnish, tracing within half an inch of the outline of the landscape, and then soften off the edges with a little gamboge (also upon the varnish side, if necessary). Should any parts of the picture print too dark, such as the foliage of leaves, they may be remedied by working in the details with a soft lead-pencil upon the varnished side. After printing from the negative in the usual way, place the print under the cloud-glass in an ordinary printing-frame, and printed under aired sunlight (previous to exposure). The frame should be covered with a folded sheet of yellow paper, and placed quite stationary; then, slowly drawing the paper from the top of the frame, exposing the sky portion to the light (care should be taken to go but very little below the outline of the landscape), and then slowly closing it again. This may be repeated several times, and usually takes from two to three minutes, so as to print according to the depth required, which will depend upon judgment and taste. Good results may also be obtained by printing in the shade, and reversing the cloud-glass, so placing the rough side of cloud-glass next to the print.—Alonzo Ferrari.

that matters little if the light is of proper quality. Admirable views may be made in a rain storm—if the sun shines.

324. In conclusion, a word as to the dark-tent. Any light enclosure set at a proper height will do, large enough to accommodate the hands during the necessary manipulations of the plate. A light frame of wood, with non-actinic cloth to form the body, is all that is needed. The form and size must suit your purpose. Have sleeves added for the insertion of the arms, and a peep-hole to see what you are doing inside is also essential. Mr. Robinson's excellent *Pictorial Effect in Photography* elaborates this subject to a charming degree, and should be consulted by all landscape lovers.

324. To dye cloth for tents, dark-room windows, etc., make the following solutions:

No. 1.—Acetate of Lead,	1 ounce.
Water,	1 quart.
No. 2.—Bichromate of Potash,	1 ounce.
Water,	1 quart.

Dip the cloth in No. 1, drain a little (but do not wring it), and dip in No. 2; it takes the color instantly. Rinse slightly, and repeat two or three times. If the cloth is new, it should be washed thoroughly, to remove the dressing, before dyeing. Wash or rinse out all loose color and hang in the sun to dry. This will give a deep, rich lemon color, composed of chrome-yellow, and perfectly non-actinic.—J. L. Gihon.

LESSON U.

BROMO-GELATIN EMULSION WORK.

325. It has long been the hope of the photographer, and the ambition of the photo-inventor, to secure some means of producing photographic negatives without the aid of the nitrate-bath, which would not only end the miseries that attend upon bath or "wet" work, but which would also secure greater rapidity of exposure. Many, many processes have been offered with more or less success in producing fair results, but the great process desired was not among them. It would be out of place here to go into even a brief history of the matter. Suffice it to say, that in the process now well and favorably known as the Gelatino-Bromide or Bromo-Gelatin Emulsion process is found the one that up to date comes nearest to what is wanted. It is now most extensively used in Europe, and at the time of the publication of this work is becoming largely employed in America. Our photographers, however, are not yet enough advanced in its practice to give us much literature on the subject, and therefore free use is made of what kind friends abroad have published, with the hope that the fraternity here will follow suit when they become more skilled, which indeed they have already begun to do.

326. Thus far the new process has been more extensively applied to out-door work than to portraiture, and the two drawings annexed speak

326. Among the many advantages of gelatin plates over wet collodion, such as their being always ready for use, their capacity of waiting for exposure in the camera without risk of spoiling, their ability of securing an image in dimly-lighted places by an indefinitely-prolonged exposure, the convenience of postponing the development, the capability of correcting over- and under-exposure by the management of the developer, to say nothing of the crowning glory, their extreme rapidity; in addition to all these advantages there is one other that is by no means so obvious; this will, I trust, in due time be recognized, namely, the means these plates supply of avoiding the known defects of portrait lenses. Hitherto, in our anxious desire for rapid working, we have been obliged to tax the optician's skill to the extremest extent to make up for our deficiency in chemical power. Hence lenses have been made of such large diameter, and of such short focus, that they can rarely be satisfactorily employed except by the free use of diaphragms. The advantage of the costly instrument is

more for the advantages of it in the former line than anything else that can be said. In the one we see the landscape photographer of the "wet"

Fig. 74.

Fig. 75.

persuasion starting out, staff in hand, his apparatus laden upon his bended back, for a day's pleasure.(?) In the other is the advocate of emulsion pursuing the same errand, but with his apparatus complete carried in one hand, with plates sufficient for a day's work. The other advantages besides portability are, that the plates for use with the emulsion processes may be prepared in the studio, and after exposure they may be boxed and developed at any convenient season—months hence, if necessary. Again, greater rapidity is secured by their use—even instantaneity—while the results are fully equal to those by the "wet" process. With these advantages remembered, then, let the process be considered.

thus materially lost. But what I object to in portrait lenses much more than their price, is the nature of the definition they give, even at their best. There is always that painful obtrusion of the optical plane where the exact focus is determined. Everything before and behind this plane runs so rapidly into "fuzziness" that the exactness of the definition where the image is sharp makes the absence of it the more obvious. We have for years been crying out for what opticians say is a practical impossibility—"depth of focus." The attempt to obtain a "distributed focus" by the patent means of partially unscrewing the back lens instead of giving increased "depth," only ends by producing general "muzziness."

The weakness of the portrait lens is never so much seen as in the attempt to take large heads. This was particularly shown a few years since at the photographic exhibition, when prizes were offered for the production of life-size heads taken direct. The portraits then shown displayed clearly not only what could *not* be done, but also what should not be attempted; and, fortunately, we have seen none of these enormities since. Yet, so long as we needed to take babies, nervous people, dogs, and other animals (and these often in an indifferent light), we have been compelled to use these optically and artistically-imperfect instruments because our plates were not otherwise sensitive enough. I remember some twenty years since, when Dallmeyer brought out his triplet lenses, using them for portraiture. I was charmed with the exquisite nature of the image; nothing was severely sharp, and nothing was out of focus. The optical plane was there, but the gradual approach to it and the gentle retiring from it was so insensible that the definition was perfectly delightful compared to that of the usual portrait lens. But the slowness of the instruments compelled me to abandon them for studio work. Now, however, all is changed, and the rapidity of our plates will

327. As it is the policy of this work to give honor to whom honor is due, be it known then that the skeleton of the method which follows is largely made up from the best paper yet published on the subject, which was recently presented to the French Photographic Society in Paris by Mons. M. Bascher, while the notes come largely from contributors to the *British Journal Almanac* and the *Year-Book of Photography.* Thus full instructions are given in every branch of the process in all details. Doubtless the novice will find it most economical at first to make purchase of his plates, or at least the sensitive pellicle with which to make the emulsion, already prepared, as plentifully offered in the market of excellent quality by a number of American manufacturers, since the manufacture of them is attended by so many difficulties and drawbacks. Were nothing else in the way, that mule of all ingredients, gelatin, must be handled, and it requires knowledge and patience. Get acquainted

permit us to use in good light, and on reasonably-quiet sitters, this superior class of lens. I therefore strongly counsel professional photographers in good light to use for their cabinet, promenade, panel, or similar portraits the rapid rectilinear or the symmetrical lenses; and to keep in reserve, to be used only on special occasions, the more imperfect though quicker-working portrait lenses. It is not sufficient to say that by using smaller diaphragms the portrait lens can have its objectionable character removed. I think not; the image is certainly improved, but it is apt to be too sharp in one plane, and not to possess that general artistic distribution of definition the other lenses give. I also think that the large glasses of the portrait lenses furnish greater risk of admitting diffused light in the camera—flattening and degrading the image on gelatin plates—than the smaller lenses.—JABEZ HUGHES.

327. It has been established by Captain Abney and others that gelatino-bromide of silver emulsion gains in sensitiveness by keeping. It has not, however, been sufficiently taken into consideration what a very important factor in the result is temperature.

First. It may be laid down as one of the canons of gelatino-bromide of silver emulsion manufacture that the sensitiveness (times being equal) is directly as the temperature at which the emulsion is kept. At 40° F. it will be less sensitive than an emulsion kept at 80° F. The cause is not far to seek. At the low temperature, the sensitive particles are held tightly by the medium which prevents their free motion. As the temperature rises a loosening takes place, which, permitting freer motion, allows scope for chemical or molecular changes.

Second. This question of temperature has another important aspect. It has a material influence on the gelatinizing property of the gelatin. A second canon is this: The gelatinizing quality is *permanently* affected inversely as the temperature at which the gelatin is kept. The higher the temperature, the lower the gelatinizing quality induced permanently. Gelatin kept in a fluid state at a high temperature passes into the condition known as meta-gelatin, which has no setting property. Possibly pure meta-gelatin is favorable to sensitiveness, as allowing the particles of silver bromide freer play. But meta-gelatin is soluble in cold water, and probably could not be used by itself for emulsion work, as it would wash away under the developer. If it could be got into collodion, it might solve the problem of rendering

with it in harness first. Once having mastered the matter of exposure, and especially of development, it will not be hard to do more.

328. Preparation of the Emulsion.—In the dark-room, lighted by ruby-colored glass, melt separately, over a water-bath, using as mild a

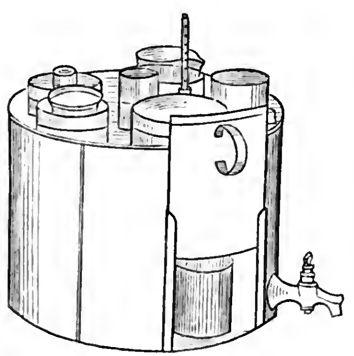
collodion as rapid as gelatin. I have not the time to make the experiments myself which would be necessary. Meta-gelatin is probably the chief mechanical cause of the increase of sensitiveness in gelatin emulsion. Being intimately mixed with the gelatin, it renders the film more pervious to the developer by being washed out, and yet perhaps not carrying away with it the particles of silver bromide acted upon by the light. There is an interesting field for experiment in this direction. If the particles of silver bromide are washed out as well as the meta-gelatin, this may explain the want of density found in some highly sensitive films.

Third. Yet, again, has temperature an important influence in gelatin work. A third canon is this: The putrefactive and fermentative conditions of gelatin in the moist state are induced directly as the temperature at which the moist gelatin is kept and placed, or manipulated, in circumstances favorable to the admission of germs from the atmosphere. Dr. Maddox—who has distinguished himself as a pioneer in gelatino-bromide of silver emulsion work—has been even more distinguished in microphotography. I would suggest to him a fertile field in the examination and photographic delineation of gelatin emulsion which has been kept, and to which the atmosphere has had access.

An emulsion free from living organisms—*bacteria, vibrios*, etc.—will be found a *sine qua non* for good work. I am inclined to think, if the microscope were used more freely in the investigation of emulsions, we should find that some of the puzzling difficulties of gelatino-bromide of silver might be traced to gelatin in process of putrefaction or fermentation, in consequence of having been kept without the addition of an antiseptic. As last words in regard to this subject of temperature, I would say, gelatin boiled is gelatin spoiled.—Duncan C. Dallas.

328. Dr. J. Nicol gives a description of a very convenient arrangement, devised by Mr. J. G. Tunny, of Edinburgh, for keeping the various vessels containing emulsions at the proper temperature. This he has called a "hot-water cabinet." It will be seen from the accompanying sketch, Fig. 76, that the cabinet consists of a cylinder of japanned tin plate, nine inches deep and thirteen inches in diameter. In the top are six circular holes of various sizes, suitable for the vessels intended to be kept warm, including one funnel, one or more measures, several beakers, and the emulsion bottle. In each of the circular holes is inserted and firmly soldered a tin cylinder, closed at the bottom, and of such a length as just to hold the article for which it is intended. The mouth of each of the cylinders projects sufficiently above the top of the cylindrical body of the cabinet to form a shoulder on which to slip a cap or cover, whereby light may be excluded from all or any particular one at will. Immediately in front of the funnel-holder—which is, of course, not a cylinder

Fig. 76.



heat as possible (that of a lamp whose light is hid is the best), the following two preparations:

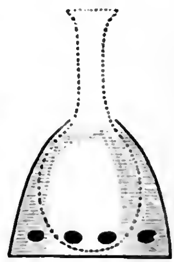
A.—Water,	120 parts.
	Nelson's Gelatin, No. 1,	15 "
	Bromide of Ammonium,	7 "
	Bromide of Zinc,	1 part.
B.—Water,		30 parts.
	Nitrate of Silver,	12 "

These two solutions being made, pour, drop by drop, constantly agitating, the second solution into the first. Allow the mixture to remain

but a cone—a portion of the side of the cabinet is cut away, and covered by a sliding shutter of tin. This is intended to receive the bottle or vessel into which the emulsion is being filtered, and a half cylinder passing behind the bottle and reaching up to the funnel-holder keeps the whole water-tight. There is also a small tube, in which may be inserted a thermometer for the proper regulation of the temperature. For all or most of the operations connected with the preparation of gelatin plates I cannot imagine, and certainly have never seen, anything so exceedingly convenient. By means of a small gas- or lamp-flame, the temperature of the water may be maintained at any required degree, and if covered with a jacket of thick felt or other suitable non-conducting substance, an almost uniform temperature may be kept up for many hours without any flame at all.

In boiling the gelatin emulsion, it is of great importance that the vessel containing it should be well covered with water to enable the emulsion itself to boil thoroughly, and in order to effect this some arrangement is required to prevent the bottle or flask from turning upside down. To get over this difficulty a heavy glass bottle is often used, much to the discomfort of the worker, who generally breaks four such bottles out of every five. To those who require a simple plan of steadying a flask, I recommend the accompanying sketch of an arrangement which is easily made and answers perfectly. It consists simply of a collar formed from a piece of stout sheet-lead bent to the proper shape of, and made half an inch deeper than, the glass flask, and also pierced with several holes to allow the water to flow easily through it. When placed in the boiling water the "collar" prevents the flask from turning over, which, if not filled too full, is also hindered by its buoyancy from touching the bottom of the outer vessel. Setting aside the question of breakage, I may observe that an ordinary chemical flask should be always used in preference to a bottle, as by its use the emulsion is heated far more quickly, and can, without risk, be immediately cooled under the tap when the boiling is completed. Thus a great saving of time, and sometimes patience, is effected.—H. MANFIELD.

FIG. 77.

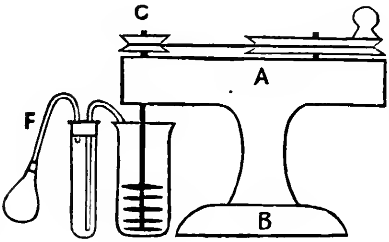


Thinking that something more mechanical than the rougher method, mostly recommended, of adding silver to the bromized gelatin and then shaking your arms off, was required, I set about making a simple piece of apparatus; and, as it answers the purpose admirably, I give a rough sketch of it, the sizes of which can be altered to suit requirements. The frame, A, is made of wood, the base, B, of something heavier to keep it steady when in use. Wood would do if loaded with lead underneath. The large and small band-pulleys are likewise of wood; the stirring-rod, C, is made of ivory, as well as the toothed piece on the bottom. This

over a very mild water-bath for three days. Now pour the solution into a glass dish, which is to be placed in as cold a place as possible; in summer, ice is necessary. When the bromized gelatin has become very firm,

stirrer, used in conjunction with an injector, gives a beautifully fine-grained, creamy emulsion, and by using an India-rubber ball on the tube, F, you can force the silver solution into the gelatin in the form of a fine spray, or drop by drop, as you think fit. A word on frilling, one of the chief causes of which I believe to be dirty glasses—that is to say chemically dirty—by allowing too long a time to elapse between the cleaning and coating of the plates. I quite agree with a plan, no doubt, adopted by many—that is, to rummage up all old plates and have one good wash up, after which they should be packed up and stored away for future use. But it is a great mistake to coat plates even twenty-four hours after such washing without a preliminary polish up. The plan I adopt is this: while the gelatin emulsion is soaking I look out my dozen or two plates, as the case may be, dust on a little fine tripoli powder on the side to be coated, and polish it off with a cloth I keep for the purpose, and which is pretty well charged with the powder. It will be found that this gives a tooth to the plate that gelatin emulsion will stick to with great tenacity. A quarter of an hour is quite sufficient to go over two dozen plates. This precaution taken, coupled with the use of chrome-alum in the emulsion, I will warrant to prevent frilling.—S. ROGERS.

FIG. 78.



In order to prevent misunderstanding, I repeat, that the method of preparing exceedingly sensitive emulsions by boiling and by treatment with ammonia give, as I have shown in my work, *The Theory and Practice of the Gelatin-Emulsion Process*, excellent results. For the practical photographer, however, and the manufacturer on a large scale, I strongly recommend the method of long-continued digesting at a gentle heat, and I will accordingly give a short *resume* of the directions which I have laid down at the end of the above-mentioned work. Dissolve 24 grammes of potassium bromide, and from 30 to 45 grammes of gelatin, in 300 cubic centimetres of water; also 30 grammes of silver nitrate in 300 cubic centimetres of water, and mix the two solutions at a temperature of about 40° C. This emulsion must then be digested over a water-bath, at a temperature of 35° C. If a less sensitive, but clear working, emulsion be required, one which shall be rich in contrasts—as, for example, architectural photographs, reproductions, etc.—the digesting must be extended over twelve hours. This emulsion will be equally sensitive, or even twice as sensitive, as wet collodion plates. It is to be thoroughly recommended in cases where a moderate degree of sensitiveness is sufficient. It should be at hand in every studio, and is often preferred by landscape photographers to a more sensitive emulsion. The same mixture, digested for three days, gives an emulsion specially adapted for portrait photographs. With a suitable developer—particularly pyrogallic—it works very soft and delicate. This emulsion ought to serve the principal wants of the practical photographer, To obtain still greater sensitiveness and softness, the digesting at 35° C. should be extended continuously for five days, and, at nearly the last moment, from one to two per cent. of ammonia should be added,

cut it into pieces with an ivory knife, and place these pieces in a canvas bag, as recommended by Messrs. Wratten and Wainright. Strongly press with the fingers, to force the gelatin through the meshes of the tissue, and allow the small fragments to fall into a dish of cold water. Stir quickly with a glass rod; then pour the whole on a sieve placed in the upper portion of a cylindrical vessel, and entering into it to the depth of

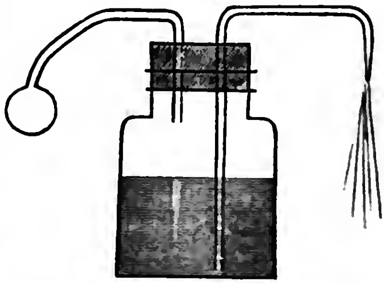
and the digesting carried on for another half-hour. In this way, it is readily possible to prepare two differently working emulsions from the same mixture. The first portion can be poured off at the end of the first twelve hours' digesting, and put on one side; the remainder being still kept cooking. I recommend the owners of large laboratories, as well as amateurs, to keep both these kinds of emulsion in stock. The sensitive emulsion can be used in the studio; the less sensitive, in the open air.—DR. J. M. EDER.

If the same quantities of chemicals are weighed up each time, it would be well to have weights made containing the exact number of ounces and grains required of each article used.

Two simple means of producing the bromide of silver in the needful state of fine subdivision are as follows:—The first is a glass funnel, with its end drawn to an exceedingly fine point. This is placed in a retort stand, and the nitrate of silver will be projected into the jar containing the bromide and gelatin solution. The whole can easily be mixed with anything found most convenient, such as a strip of glass or wood, a salad-fork, or one of those wooden mixers used in the *cafés* for the chocolate-pot. The other plan is the spray producer. This is easily made with a bottle, a good cork, two pieces of glass tubing, a piece of India-rubber tubing, and a valve-ball pear-shaped. (See Fig. 79.)

In cooking the emulsion, a good, trustworthy, well-glazed stoneware jar, with a lid or cover, will be found most useful, and a saucepan or boiler with a well-fitting lid and large enough to hold the jar; also a piece of wood to fit loosely into the saucepan. This keeps the jar from the bottom of the pan, which, when the jar is in it, should only be half filled with hot water. When cooked sufficiently, the emulsion is poured to set in a white, flat-bottomed porcelain dish placed in a zinc box with a deep cover, the whole fitting in a wooden box, which has also a deep cover fitting into a rebate set all around the outside of the wooden box. The zinc dish is made with two supports, so that the porcelain dish is from one and a half to two inches from the bottom. This space in hot weather is filled with crushed ice and nitrate of potash. There is also a little tube of zinc passing through the two boxes. To this is attached an India-rubber tube with a brass top to run off the waste water. In cool weather, nitrate of potash and water will suffice. Pieces of ice placed in the cool emulsion will help the setting. A piece of flat ebonite, about five inches by two inches, filed down to a sharp edge at one end and a hole pierced at the other to hang it up by, is most useful to scrape up the set emulsion with.

FIG. 79.

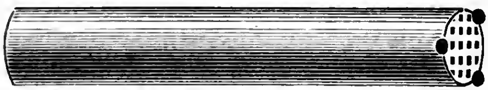


For breaking up the emulsion a canvas cloth may be used; but any mechanical means

about seven centimeters (two and three-quarter inches). The water will fall into the vessel and the gelatin will remain on the sieve. Pour plenty

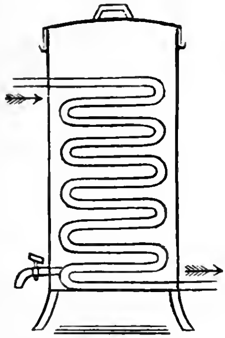
that does the same without so much handling is better. A large zinc tube, silver-coated, with a pierced plate at one end and a wooden plunger to fit the same (Fig. 80), has done good service. It is placed in a large jar partly filled with cold water and the emulsion forced through. There are three knobs or feet to keep the strainer part from touching the bottom of the jar, and this allows the emulsion to come through.

FIG. 80.



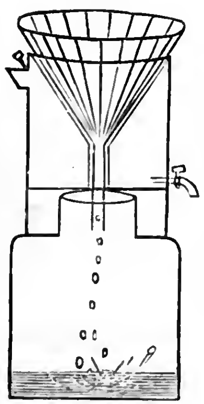
For washing the emulsion many plans are recommended, but they all are on the same principle—a means whereby the emulsion can soak awhile and then drain and again soak and drain. The finer the emulsion is broken up the less washing is needed, and excess of washing certainly causes a thin image, although a very sensitive plate is produced. During the summer, a difficulty is found by many in obtaining water sufficiently cold. An apparatus like Fig. 81 then becomes an absolute necessity. A zinc cylinder and lid fitting into a groove or rebate and some ordinary "compo," one-fourth or three-eighths piping twisted into coils, crushed ice, and nitrate of potash is thrown into the cylinder. The water enters from the top and is considerably reduced in temperature before it passes out at the other end. I do not know that it matters which way the water enters. The washing-trough containing the emulsion should be close to the cooler.

FIG. 81.



For filtering, a good wash-leather well cleaned from "dressing," a china funnel, a jar, and a tin or zinc cylinder (Fig. 82) to hold hot water are required. It is advisable to filter twice and have two leathers and two funnels. The lip is for the purpose of adding more hot water, and the tap to take off the chilled water. The tin is made to fit the funnel, and has a rim at the bottom to rest on the shoulders of the jar, long enough to prevent the end of the funnel coming in contact with foreign matter when placed on the table.

FIG. 82.



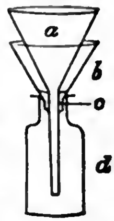
After filtration, it is well to put the emulsion aside for twenty-four hours (or it can be used at once). A good plan is to have a series of ten-ounce, lipped stoneware bottles, using a ten- or twelve-ounce measure and a funnel to fill the bottles. By this means of measuring, none of the emulsion is lost. The bottles are then covered with a piece of tough, non-actinic paper, kept in position with an India-rubber band, taken into a cool place, and when thoroughly set, about half an ounce of methylated spirit is poured on (this can be used over and over again if kept from the light). The emulsion will now remain good for a considerable time, but if it be intended to keep the emulsion, it is better to make it into pellicle *à la* Kennett. You and the pellicle can then defy summer and winter, heat and cold.—ARCHER CLARKE.

My emulsion filter is very simple and easily made, and is illustrated by the annexed

of water into the sieve until the whole of the gelatin is covered. Throw away the water in the vessel, renew three times this washing operation, and drain carefully; now take the gelatin with a horn-spoon and put it in a precipitating glass two-thirds filled with methylic alcohol. Continue this washing until the fragments of gelatin are completely hardened, which it is easy to ascertain from the peculiar noise which they make when stirred. Now with a horn-fork spread these small emulsion pearls on a glass plate, which has previously been rubbed with a tuft soaked in

diagram, Fig. 83. B is a tin funnel, with its spout cut off to about an inch in length; A is a glass funnel, with quite a long spout, so as to reach nearly to the bottom of the bottle, or dish, filtered into; a rubber bottle-stopper, C, that fits the neck of the tin funnel, B, is perforated with a hole to fit the spout of the glass funnel, A, and they are all put tightly together, as shown in the diagram. When in use, the spout of the glass funnel, A, is fitted quite tightly with a wad of filtering-cotton previously wet with alcohol, and rinsed with distilled water, and the space between the tin funnel, B, and the glass funnel, A, is filled with water at 110° F.—JAY DENSMORE.

FIG. 83.



Bromide of ammonium should be as nearly as possible *neutral*. It is usually more or less acid, even though otherwise pure, and frequently becomes strongly acid by keeping. It is then quite unfit for use, and will not give good results unless almost neutral. Since further extensive experiment, the writer has arrived at the conclusion that on the whole it is better to use bromide of potassium. The latter is often alkaline, but may, without much difficulty, be obtained neutral, and is free from tendency to alter. Nelson's No. 1 photo. gelatin unfortunately varies much in different samples. It should be absolutely free from the faintest smell or taste, and should dissolve clear, bright, and nearly colorless. Samples good for this purpose usually contain a very slight trace of HCl. Nitrate of silver is usually (if good) slightly acid, with excess of nitric acid. It may be so used, but the writer has recently found that better results are obtained if the silver solution be neutralized with carbonate of soda. A slight excess does no harm, as the resulting trace of carbonate of silver is converted into bromide; indeed, an emulsion may be made by mixing washed carbonate of silver with a soluble bromide. The uses of neutralizing the silver are twofold. One is, that as the amount of acidity of $AgNO_3$ varies with different samples, it insures the same conditions in all cases; the other is, that the presence of nitric acid in emulsion produces a tendency to green and pink discolorations in the finished negative.—W. WILSON.

When the gelatin emulsion is flowed over a glass plate, and does not set for a long time, though the temperature of the air and of the plate is not very high, place the plate on a cold metal or stone slab (10° C). If that produces no effect, the emulsion has been spoiled, either by continued cooking at a great heat (60° to 100° C.), or by repeated alternately melting and solidifying, the latter being specially injurious when the gelatin is of inferior quality. For this reason it is better not to keep the stock of gelatin emulsion warm, but to plunge the flask at once into cold water. When gelatin is heated continuously for a long time with ammonia, it loses its property of solidifying, and the same happens to an emulsion digested with more than five per cent. of ammonia. The best means to put it right again is to add about half its quantity of the original gelatin. By long keeping, the gelatin will

benzole and wax; thoroughly dry without using heat; this requires about twenty hours. At the end of this time detach the emulsion from the plate with a paper-knife, or simply with the palm of the hand, place it on a sheet of black paper, and then in small pasteboard boxes, in which it may be kept for an indefinite time if not exposed to dampness or light.

329. Manner of Spreading the Gelatin on the Plate.—First cover the plates which are to receive the gelatin with a thin coating of albumen:

Water, ...	500 parts.
White of Egg.	20 "

to which you add a solution of chrome-alum in sufficient quantity to impart a rather dark-bluish tint. Allow this first coating to thoroughly dry,

often putrefy, and then it becomes a fluid of its own accord, and loses the power of solidifying. This can be prevented by adding from one to two per cent. of salicylic acid or of thymol dissolved in five cubic centimetres of alcohol for every one hundred cubic centimetres of gelatin. Separation of the film from the glass during development, formation of bubbles, protrusion of the layer of gelatin over the edge of the plate, production of creases, distortion and tearing of the negative image—all these defects are due to the employment of too soft a gelatin; by using collotype gelatin they may be avoided. The same effect is produced when the emulsion contains a considerable amount of gum-arabic. It may be cured by cleaning the glass with a weak solution (1:200) of soluble glass, which causes the gelatin to adhere more firmly; coating the edges of the plate with a varnish of caoutchouc is also a remedy. A complete cure is obtained by, previous to developing, dipping the plates for about five minutes in a saturated solution of alum in water, followed by thorough rinsing. According to Chardon, it suffices to dip the plates in alcohol, and only to develop afterwards. Light-colored spots, without any sharp outline in the negative, may be attributed to some fatty substance in the gelatin; the spots may be got rid of, and the silver bromide plates rendered homogeneous, by filtering the gelatin several times through filter paper.—W. P. Bolton.

329. For coating and drying plates my levelling-board is three feet by two feet and six inches, one and a quarter inch thick, with two stout battens crossways of the wood underneath. This requires to be pretty stout and rigid, and made of good dry timber. Across the surface there are fastened strips of wood half an inch square and at three-inch intervals. These are simply guides in the process of levelling: a lid, made as light as possible, but light-tight, and of sufficient dimensions to cover the entire board, with a flange sufficiently deep (say three inches) to cover the board-plates and for the lower edge to rest upon the table.

To level the plates, make a lot of little common clay cylinders by rolling the clay into lengths of a few inches and about half an inch in diameter, and cutting it up into about three-quarter inch lengths; three of these pieces of clay are used to each plate. The pieces of clay are placed on the leveller's board at such a distance as to suit the size of plate, and on each piece of clay I press a gun-wad; upon these the glass rests. A circular spirit-level, or two ordinary spirit-levels placed at right angles upon the plate, enables you to see which way the plate requires pressing down upon the clay supports to set it perfectly level. I have tried all sorts of means of levelling the plates, but find this the best and most simple; a little

then spread over it by the aid of a bent glass rod the gelatin emulsion, which has first been dissolved over a water-bath at a very moderate heat, and in ten per cent. of ordinary water slightly alcoholized. Some add to the emulsion a small quantity of chrome-alum to preserve the adherence; others, a few drops of ammonia to increase the sensitiveness. Thoroughly

practice will enable you to level the plates rapidly and perfectly. I never exceed half an hour in levelling sixteen plates.

Coating the plates: During the time I am levelling the plates, I have one of the pots of emulsion placed in some hot water in the "laving can" over my gas-burner, with just sufficient gas to keep the water hot, *but not to boil*—say at a temperature of 130° or a little more. By the time I have levelled my plates, the emulsion will be melted and heated up to the same temperature as the surrounding water. Now commences the dark-lantern business. My lantern is a wooden box, twelve inches every way, the front consisting of two panes of glass, which slide in grooves, and are sufficiently long to be easily taken hold of and lifted out. The one glass is ordinary sheet, coated on one side with negative varnish, containing a sufficient quantity of aurine to make it a tolerably deep yellow; the other glass is ordinary ruby. The slides are arranged to leave one inch space between the two glasses; a paraffine lamp is placed inside the box, which is provided with a good-sized chimney, such as are used for magic lanterns. The yellow glass is nearest the light, and the ruby outside; this gives plenty of light, is perfectly safe, and about as cheap and convenient as anything you can get. Proceed to filter the emulsion through a good tuft of cotton-wool placed in a funnel. Place a glass marble upon the cotton-wool in the centre; it prevents the wool rising when the emulsion is poured upon it. Before pouring the emulsion on, pass some hot water through the cotton-wool, and pass the emulsion through *twice*, at least.

The pouring-bottle consists of a blue pyro bottle, close to the bottom of which I have bored a hole, and into this hole I introduce a glass tube, with a portion of India-rubber tube upon it to make it water-tight, and tie a string round the tube and neck of the bottle to hold the tube in its place. This is my pouring-bottle. You will see my object is to pour from the *bottom, thus avoiding air-bubbles.* The tube is simply a "feeding-bottle" tube, and the whole thing does not cost a shilling, but is worth a good deal for this job. Heat the bottle in warm water, filter the emulsion directly into it, and set it in a basin of hot water for immediate use.

In coating, pour the emulsion out of the bottle into a glass measure (I have several sizes), using a drachm to every ten square inches of surface; thus, a ten by eight will take eight drachms or one ounce. I consider it very important to measure the quantity on each plate. Spread with a light bent glass rod, and when all the plates are coated put the lid over, and you can admit white light until they are set, which will probably be in two or three hours. Do not disturb them till thoroughly set, then transfer them to the drying-box, light the Bunsen burner, and in about twenty hours the plates will be dry.

In storing the plates when dry, place them face to face, *without anything between them;* wipe the backs from any emulsion that may be upon them, and so place them in pairs. I usually make them up in parcels of eight plates, the box, etc., being adapted for making sixteen plates at one heat. I wrap up in yellow paper two thicknesses and brown paper ditto. —J. A. FORREST.

dry in a current of air, and where there is no dampness. You will now have sensitized plates of excellent quality, ready to be used or packed away. These plates, carefully packed, may be indefinitely kept, as well as the emulsion, but, like the emulsion, they must be protected from dampness and light. Remember, in *all* your manipulations, how very sensitive

The drying-box is illustrated in Figs. 84 and 85. A is an oblong box 7½ x 11 inches, and 30 inches high, inside measurement. B is a tin tube 4 inches in diameter, and a little longer than the height of the box. *a* is another tin tube, 2 inches in diameter, reaching from the diaphragm, *g*, in the large tube, up through its top. The tubes *d* and *e*, each 1¼ inches in diameter and 4 inches long, connect the large tin tube with the box, the tube *e* entering the box 1 inch below its top, and the tube *d* 1 inch above its bottom. The shelves, 2, 2, are each fastened tightly in the box, but are each only 10 inches wide, thus leaving a space at their ends 1 inch wide between the doors of the box, C. The large tin tube, B, is perforated with a row of half-inch holes just above the diaphragm, *g*, to admit air. The lamp, *c*, is placed in the bottom of the large tin tube. The sides of the box, A, between the shelves, 2, 2, are full of grooves, 1¼ inch deep, 1¼ inch wide, and 1¼ inch apart, as shown in the sectional figure, 85. I use only 5 x 8 and 8 x 10 plates; and when I begin putting plates in the box, I slide the first plate into the first upper pair of grooves, leaving it so that the door of the box will touch it when it is closed. If the plates are 5 x 8, I put two plates into each pair of grooves, and if 8 x 10, only one. The second plate I put in the second pair of grooves, but slide it back against the back of the box. The third I lean against the door, and the fourth against the back, and so on until the box is full or the batch is all in. The figures 1,1,1,1,1 show the position of the plates in the box. When the plates are all in, I close the door, C, which fits tightly, and light the lamp in the bottom of the tin tube. I use a small night-lamp, burning kerosene oil. The air for the lamp has to come through the tube, *d*, and out of the box, A. The heat of the lamp warms the tube, *a*, also warming the air in the space between the two tubes, which rises and passes into the box, A, through the tube, *e*, its place being supplied with cold air through the holes in the large tube just above the diaphragm, *g*. A current of warm air (as shown by the arrows in Fig. 84) is thus kept up over the plates, and they will dry very quickly. The upper ones will dry first, and, as they dry, it is well to shove them in against the back of the box, thus giving the warm air a better chance at the plates below. A batch of plates, from four ounces of emulsion, put in in the evening will be nice and dry in the morning.—Jay Densmore.

Fig. 84.

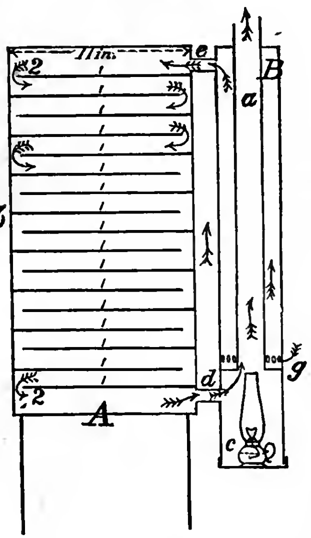
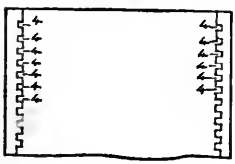


Fig. 85.

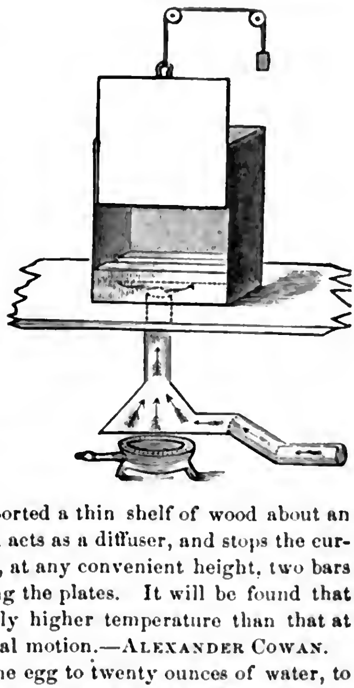


It often happens, in very damp weather, that a gelatin negative refuses to dry for hours,

gelatin is to dampness, how the least change in this respect will change the nature and the action of gelatin in any form. And when it is sensitized, the light coming upon it will spoil it instantly. Dry air and freedom from light are positively essential to success.

and even when flooded with spirit takes a considerable time. To those who do not possess a good drying cupboard, the following is offered as a thoroughly efficient substitute, which any one can make for himself with a little help from the blacksmith. The annexed wood-cut will almost explain itself. The box may be of any form most convenient, but the more shallow the better; the one in actual use stands on an ordinary work-bench, and the gas-burner and iron cone, etc., on the floor, enclosed with a few bricks piled up to keep in the heat and protect any woodwork. The box measures thirty inches high, thirty inches wide, and ten inches deep from back to front; the front is closed up at the lower part about six inches, and a sliding door, running in grooves, closes the upper part all but about half an inch at the top, a balance weight over a pulley supporting it in any position required. This is found a much better way than having doors opening on hinges, for various reasons. The current of warm air is conveyed in at the bottom, through a three-inch circular opening, the iron stove-pipe arrangement being screwed on underneath. Above the opening, at a little distance, is supported a thin shelf of wood about an inch smaller all round than the inside of the box, which acts as a diffuser, and stops the current of hot air from rushing up in one spot; above this, at any convenient height, two bars are fixed to carry the feet of the drying-rack containing the plates. It will be found that plates will dry without running, at a very considerably higher temperature than that at which gelatin melts, if the heated air is kept in continual motion.—ALEXANDER COWAN.

FIG. 86.



I use the following substratum: Take the white of one egg to twenty ounces of water, to which add an ounce of methylated spirit and about twenty drops of carbolic acid. It is better to add the carbolic acid to the spirit and stir, and then add the whole to the albumen; agitate well, allow to stand until next day, and filter clean. This will keep for months. I find this a "perfect cure" for frilling; the substratum adheres thoroughly to the glass, and the gelatin adheres thoroughly to the substratum. No alum water is necessary while developing, nor any tampering with the emulsion. I have never lost a single plate from frilling since I adopted this method, but dozens before.—J. A. FORREST.

Defects in plates. *Spots* may generally be discovered by passing the finger softly over the surface. Local *intensification* may be given by applying a saturated solution of bichloride of mercury with a brush to the parts requiring it, and local reduction may be obtained in the same way, substituting potassium cyanide for mercury salt. White points or round spots with a sharp outline, which, after fixing, have a glassy appearance, are caused by air-bubbles adhering to the plate, and preventing the developer from penetrating. These bub-

330. Exposure.—The length of the exposure varies considerably according to the sensitiveness of the emulsion; generally, one or two seconds are sufficient to take a well-lighted view. In the glass-house, where care must be taken to avoid contrasts, and to throw the light uniformly upon the subject, the exposure varies from three to six seconds. In thirty seconds we may obtain a very good effect, even when the light is so weak that it would be impossible to obtain a portrait with wet collodion. Make use of a shutter, especially for outside work; as, with the rapidity possessed by gelatin, it is indispensable that the foreground should be exposed a little longer than the distance. In twenty minutes it is possible to obtain an interior lighted with gas; and the prints, by contact, may be made by lamplight.

Concerning instantaneous work, for which gelatino-bromide seems to have been invented, more further on.

Gelatin plates may be exposed just as well when reversed as in the ordinary position, care being taken when focussing to consider the thickness of the plate, or to use a plate-holder made on purpose to correct the difference.

bles may be avoided by rinsing the plates with water before development, or by a gentle movement of the pan during the same. They can also be removed by a camel's-hair brush at the same time. Irregular lines and spots make their appearance when there is too little developing solution flowed over the plate, so that portions only are covered. In this case, also, if the plate be previously moistened with water, a less quantity of developer will be required.—W. P. Bolton.

330 One of the great claims in favor of the gelatin-emulsion process was and is its great rapidity. Every manufacturer of dry plates calls them "instantaneous," and undoubtedly they are so, provided the lens, its aperture, the amount of light, the nature of the subject, etc., allow of "instantaneity." Unfortunately, however, the cases which admit of instantaneous exposure (whatever the real signification of the expression may be) are very few, and not often met with. It is not so very long ago, however, that a doubt on this subject would have been considered heresy, and that the unfortunate proposer thereof would have been condemned for his ignorance. Not a few would have made us believe that the same description of lens, which, with a given diaphragm, would give an instantaneous picture on a 4½ by 3¼ plate, would perform the same feat on a 10 by 8 plate. Four P.M. in June, or in November, a sea view or a dark forest—every subject was to be taken instantaneous; we could not work quick enough. I think experience has already shown the fallacy of those statements, and nearly every number of the *News* contains some sort of warning on this score. As I wish to endorse these warnings, I beg at the same time to give my brother-amateurs the reason why. In order to obtain a perfect gelatin negative, I have observed that the development must not take too much time. Pyrogallic acid—either used with ammonia and a bromide, or with ferri-cyanide and ammonia—is apt to stain the plate wherever

331. Development.—And here is where genius is most needed. It is important that the development should be made in a large and cool room. If yours is not of this kind, take the precaution to place in cool water the solutions which are to be used in developing and fixing the image, and use for the washings water as cold as possible. On the question of developing the gelatino-bromized plates, the opinion of photographers is equally divided—some will only use the iron developer, others, pyrogallic acid. It is well to have ready both of these developers, as each one possesses its particular advantages. Iron is without doubt the most certain and the easiest to use, but the operator who understands thoroughly the

the development has taken too long in consequence of too short exposure. And, moreover, I have experienced that with the ferri-cyanide, under these circumstances, the plate almost refuses to fix in the shadows, producing partly red or yellow fog. With the oxalate developer it appears that the development of under-exposed plates only proceeds to a certain point, and then stops altogether. As I only work landscapes, as a rule 10 by 8, it is of course necessary that the printing depth at the corners should be as good as in the centre, and this object I find impossible to attain where the exposure has been too short After fixing, the image, from a good negative in the middle of the plate, will merge into a fine positive at the sides. Intensification with bichloride of mercury will not do much good in these cases, for it seems as if this salt has a greater propensity to take hold of the well-developed parts of the picture, affecting the remainder less; and it should be well borne in mind that the mercury followed by ammonia strengthens, but does not develop.—H. L. T. Haakman.

331. But the *time* taken in development has a great effect towards or against success. Take any gelatin plate, expose on any subject, each half equally, and then cut the plate. Develop one-half in a given quantity of developer of the strength requisite to complete the development quickly; then develop the other half in the same quantity of water, but adding the reagent little by little, taking some time to acquire the same strength of developer as was used with the first half. You will find the slowly-developed plate will give a negative much denser and more brilliant than the quickly-developed one. From this it results that for a subject wanting in contrast, or a little over-exposed, it is safer to develop slowly; while a highly-contrasted subject will be the better for a development short and sharp. In whatever form you keep your stock solutions, have ever at hand strong solutions of ammonia, pyrogallic, and bromide. I use the same stock solutions—pyrogallic, glycerin, and alcohol; ammonia, bromide, glycerin, and water—for every kind of gelatin plate. When I get a new make of emulsion, I never dream of making up my developer by the maker's formulæ; if I did so, the facility of comparison would be lost. Stop development when there is no longer any pure white to be seen on the face of the plate, and when the high-lights can be seen at the back. This rule, however, does not hold good for every kind of subject: practice in this matter is the best guide. You must have enough light to see clearly what is going on on the plate, and, what is more, you must scrutinize carefully each change that takes place. This can *not* be safely done with a light that does not affect the solar spectrum; but it *can* be done with plenty of light of the right kind. Suit your development to your subject—your cartridge to your gun and your game.—Andrew Pringle.

manipulation of pyrogallic acid may decide to give it the preference, especially for landscapes, as his prints will have more delicacy and clearness.

332. These two developers are to be used in the following manner: At the *exact* moment of developing pour into a *black dish* made of hard rubber or pasteboard, for a half plate (13 x 18 centimetres) (five to seven inches), 50 c.c. (one fluid ounce five fluid drachms) of the iron bath which you use for the wet collodion, namely:

Water,	100 parts.
Pure Sulphate of Iron,	6 "
Acetic Acid,	6 "
Alcohol,	5 "

Add in the dish 55 c.c. (one fluid ounce seven fluid drachms) of the following solution, which does not change, and consequently can be prepared beforehand:

Water,	1000 parts.
Neutral Oxalate of Potash,	300 "
Bromide of Ammonium,	1 part.

[The neutral oxalate of potash solution may be also obtained by melting with the aid of heat in a litre (one quart) of ordinary water, 200 grammes (6 ounces Troy 3 drachms) carbonate of potash, and 157 grammes (5 ounces Troy) of oxalic acid. Absolute neutrality is not necessary. The solution made and filtered, always add one gramme (15 grains) of bromide of ammonium.]

Now plunge the plate into this mixture without waiting. If the plate is long, it should pass through ordinary water. Gently rock the dish;

332. I attribute the majority of failures in the gelatin process to over-exposure. The pyro and ammonia is so rapid in its action, and if prolonged over a considerable time by the addition of a little more ammonia, pyro or bromide, the film is liable to stain, which lowers the brilliancy of the resulting print. Now, with the ferrous oxalate the case is different. Prolonged development has no effect on the shadows, which remain bright if the development extend over a very long period. It is always better to err on the side of over-exposure, for by careful manipulation a good negative can be secured, while it is almost impossible to get a satisfactory result from under-exposure. The plan I recommend is to have a series of ordinary dipping-baths. No. 1 to contain one part of a saturated solution of protosulphate of iron, mixed with three parts of saturated solution of oxalate of potash; No. 2, one part to six; No. 3, one part to twelve; and No. 4, one part to twelve, with three grains of bromide of potassium to each ounce of solution. To commence: Put the exposed plate in No. 3. If the development appears to be going on satisfactorily, it may be completed in that solution; should it appear too slowly put it in No. 2, and, if then not fast enough, into No. 1, where it may remain until properly developed. If the exposure be correct, the time ought not to exceed five minutes. If there be plenty of detail but a want of density, put it into No. 4, and allow it to remain there until sufficiently dense. If it show up too rapidly

in thirty seconds the high-lights should show themselves, and in three minutes the *cliche* should be developed. In all cases the action of the developer should be allowed to continue until all the details are *very apparent*, which it is easy to see by reflection, the image showing itself white on a black ground; and until you have obtained the desired intensity, which you will always recognize by transparency, provided the emulsion is not thicker than it ought to be, do not fear to prolong the development even beyond the point at which it appears to be sufficient, especially if the coating of emulsion is thick. The same developer may be used to develop two or three plates, but it should be renewed for a fourth; now wash with care, and place the plate in a ten per cent. hyposulphite bath, in which it is allowed to remain double the time necessary for its complete clearing or fixing. It is necessary to change the hyposulphite bath as soon as it acquires a too decided yellow tint, as, if care be not taken, this tint may show itself on the negative. It is for this reason that it is better to have the hyposulphite bath in a *porcelain* dish, in which it is easier to perceive any change of color. On taking the plate from the

when in No. 3 put it into No. 4, and finish in that bath, unless it appears to be coming out too slowly, when wash the plate, and put it into Nos. 3, 2, or 1 to get the proper detail. These solutions can be repeatedly used if decanted after use into bottles kept full to the cork; or may be allowed to remain in the baths if covered with paraffine, benzoline, chloroform, or ether. In that case the plate must be made wet before immersing in the developer. I am presuming that over-exposure is the rule; under-exposure requires a fifth bath, containing the old ferrous-oxalate developer, composed of an excess of oxalate of iron dissolved in a hot saturated solution of oxalate of potash, or, failing a supply of oxalate of iron, dissolve protosulphate of iron in a boiling saturated solution of oxalate of potash. These solutions decompose more rapidly than the mixed saturated solutions, hence the necessity of covering them as soon as mixed with paraffine. To sum up: The advantages are—cleanliness, development in the light of an ordinary dark-room, leisure in watching the process of development, no after-intensification, absence of stain, which facilitates printing, and brilliant prints resembling ordinary wet-plate work.—F. YORK.

Try the iron development as given in our directions. It is so simple and easy to manage that anybody of common sense can work it successfully, and does away with the many bottles and continued measuring of the developing solutions, which take so much time and attention with the alkaline development. The iron is more economical and works fully as quick, and the negatives obtained thereby resemble very much the ordinary collodion plate. Furthermore, there are no fumes of ammonia created in the dark-room, which are so injurious to the silver bath. If a negative developed by iron is treated with a *cold* mixture of eight parts water and one part sulphuric acid after mixing and washing, it will be much improved in clearness. Negatives developed by pyro have sometimes a yellow color which makes them print slowly; this can be readily removed by pouring on water containing twelve drops of nitric acid per ounce. Our method is as follows: Oxalate:

fixing-bath wash carefully, and instead of setting it aside to dry, as you are in the habit of doing with a wet-collodion plate, place it to soak in a bucket of ordinary water. When the day's work is done, remove the plates from the tub, and in daylight examine them well, one after another. If the exposure has been good, and the development well done, almost all of them will be right, and you will have nothing further to do with them. If some require strengthening, place them successively in the two baths indicated by Dr. Monckhoven for this purpose, care being taken to wash them carefully between each bath. The whiter the film becomes in the first, the greater the strength acquired in the second. If the desired result is not obtained in the first trial, you may without injury, after washing, repeat the operation.

Bath 1.—	Water,	100 parts.
	Bichloride of Mercury,	2 "
	Bromide of Ammonium,	2 "
Bath 2.—	Water,	100 parts.
	Nitrate of Silver,	2 "
	Pure Cyanide of Potassium,	2 "

For the second bath of cyanide of silver you may often use with ad-

Dissolve as much neutral oxalate of potassium in hot water as the water will take up (the proportion is about one to four parts), and allow it to cool. Test with blue litmus-paper; if the color of the paper remains blue, add a little of a concentrated solution of oxalic acid in water until the paper turns slightly red. Iron: Make a saturated solution of protosulphate of iron in hot water. Let it cool, and stand until settled. Decant the clear solution, and to each ounce add one drop of sulphuric acid. For the developer, mix of the two solutions enough for one day's use, in the proportion of one part iron solution to four or five parts oxalate. Add the iron to the oxalate, but never the reverse. The fresh developer is very powerful, and apt to produce flat pictures, but after being used a few times, or by getting old, will soon lose in strength, and develop slowly, with too much intensity. Therefore, the best way to proceed is as follows: Have two bottles of different shapes, but of same size, one for the new and one for the old developer, which bottles should be cleaned once every day. After developing a plate, pour the solution from the developing-dish into the bottle for old developer. Commence to develop the next plate with the old developer which you had saved, moving the dish gently, and if the picture comes out too easily, it is a sign of over-exposure. In this case add a little water to it; but if after a minute the picture does not begin to appear, pour away a little of the solution, and add some from the fresh, which will bring out the picture clear and brilliant; for very short exposure, throw out the old solution entirely and finish with fresh. Wash, fix, and intensify, or reduce the same as described before.—CRAMER & NORDEN.

Many photographers have complained, and still do so, of the fogged and flat appearance of a negative developed with ferrous oxalate, and certainly not without cause; but the

vantage (though with the utmost caution, for it is just here that many a previously good result is totally spoiled) a solution of ammonia:

Water,	100 parts.
Ammonia,	15 "

There is still another very convenient strengthener, that of bichloride of mercury. This being composed but of a single solution, it is easier to follow its action than it is with the preceding one; but it is open to the objection of slightly fogging the plate, whilst the other makes it clearer. This strengthener is composed, as you know, of the following three solutions:

1.—Water,	180 parts.
Bichloride of Mercury,	4 "
2.—Water,	60 "
Iodide of Potassium,	6 "
3.—Water,	60 "
Hyposulphite of Soda,	8 "

If, instead of being strengthened, some of the plates should be weakened, place them either in a weak bath of perchloride of iron, or in a highly diluted solution of cyanide of potassium; for example, one part for two hundred and fifty parts of water, and stop the action of the bath at the proper time. The plate finished, strengthened, or weakened, should again be washed and allowed to remain five minutes in the following bath:

Water,	100 parts.
Alum,	10 "
Alcohol,	4 "

This last bath possesses several advantages; in the first place, it purges the print of the injurious salts that it might contain, gives it more lim-

remedy is in their own hands. This effect I have invariably found to be produced when the oxalate of potash has proved to be *alkaline* instead of *neutral.* To remedy this there should always be at hand a small bottle containing a saturated solution of oxalic acid, and when the required quantity of potash oxalate has been dissolved in hot water, a drop of it should be placed on a piece of red litmus-paper. If it turn the paper slightly blue, then a few drops of oxalic acid should be added, and the liquid stirred well. Test again with red litmus-paper, and if it still turn the paper slightly blue, then add a few drops more of the oxalic acid solution. If found on trial again that it is neutral by its neither affecting the red nor blue litmus-paper, then the desired quantity of ferrous oxalate may be added, and the solution made up complete by the addition of a few grains of bromide of ammonium. If ferrous-oxalate developer be made from an *alkaline* sample of potass oxalate, the resulting negative is always foggy and weak in appearance, no matter how good the gelatin plates

pidity, renders it much more solid, and makes its preservation certain. Now wash for the last time, and until the disappearance of any greasy trace, and dry *without the use of heat.* This drying generally requires a long time, but you can make it much shorter by dipping the plate in an alcohol bath, and allowing it to dry spontaneously, which requires about a quarter of an hour.

333. Pyrogallic Acid Developer.—Prepare the following solutions:

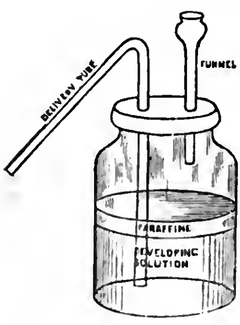
1.—Distilled Water,	500	parts.
Pyrogallic Acid,	3	"
2.—Ordinary Water,	500	"
Bromide of Ammonium,	6	"
Ammonia,	10	"
A.—Water,	10	"
Ammonia,	10	"
B.—Water,	20	"
Bromide of Ammonium,	10	"

These last two solutions, A and B, being used only in very small quan-

may be; but if the same sample of potass oxalate be neutralized by the addition of oxalic acid, the resulting negatives have all the printing density required, with beautiful and clear shadows. Although the same sample of plates may be used, that with the *alkaline* potass oxalate gives thin and foggy negatives. If every photographer who uses the ferrous-oxalate developer would test his potass oxalate before using, he would then know the true power of his developer, and have it more under control than in working by rule of thumb.—A. J. Jarman.

The apparatus for preserving ferrous-oxalate developer consists of a pickle-bottle, in the cork of which are inserted two tubes. One tube is bent for delivery of the solution into a tray when required for use. The other is a thistle-headed funnel through which to pour it back into the bottle. A layer of paraffine protects it from the air. In using this bottle the mouth is applied to the funnel, and air is blown through it to expel the liquid through the delivery tube.—T. H. C.

Fig. 87.



333. Successful development depends upon—1. Extraneous circumstances, that is, accommodation, light, and mechanical contrivances, on which points I have nothing here to say. 2. Proportions of the reagents employed. 3. Length of time employed in the process. 4. Like success in everything else—brains. Upon this last essential depends the success of the entire operation. Now, in blindly following out the printed instructions of a plate manufacturer, or the confidential directions of some friend at headquarters, who knows all the "bigwigs," brains can play no part, so that nothing is left for our brains but to comprehend the *rationale* and practice of Nos. 2 and 3.

Every one knows that "pyro gives density, ammonia detail, while bromide keeps the

tity, are kept in bottles having a drop-tube. To develop, make a mixture of equal parts of the first two solutions, No. 1 and No. 2. If the exposure is good, this mixture is sufficient to completely develop the print.

shadows clean and checks over-hasty development;" but how many put their knowledge to any use? Our friend, Mr. Phocus, has had a field-day. In his slides he has plates bearing the "latent images" of a landscape or two with fine distances, a duke's country-seat, a waterfall in deep shadow, and perhaps a happily-caught cloud effect. In his dark-room he finds Mr. Collodion's printed instructions, thus:

Pyro,	2 grains.
Water,	1 ounce.
Ammonia liquid, fifty per cent. solution,	2 drops.
Bromide of Potassium, five per cent. solution,	2 "

or something of that kind, and straightway makes up enough of these solutions to develop all his negatives. He is surprised to find his landscapes nearly clear glass, his mansion-house *almost* a success (barring, perhaps, the foilage of a splendid and characteristic elm), his waterfall as hard as if it were an icicle, and his cloud—*nil!* "Would he be surprised to hear" that if for his landscape he had doubled his pyro and halved his ammonia, if for his house and tree he had reduced his bromide, if for his waterfall he had halved his pyro, doubled his ammonia, and modified his bromide, and if for his cloud he had halved the whole lot, he would have got a negative uniform and probably fairly good? The moral is this: When you have a subject wanting in contrast—such subjects are rarely under-exposed —use as much pyro as you like, only as much ammonia as will bring out all detail, and as much bromide as will keep the shadows clear. When you have strong contrast, keep down the pyro and with it the density, and do not counteract the ammonia with too much bromide. When making cloud negatives for printing into landscapes, remember that you only want the image clearly defined, any further density simply causing waste of time in the double printing. Of course many will say, "Oh! I knew all that before." I say, "Then do it!"—Andrew Pringle.

I prefer to develop very slowly, as one has more control over results, and therefore adopt the following method. My alkaline developer is made of a solution of—

Pyrogallic,	3 grains.
Bromide of Ammonium,	30 "
Strong Ammonia,	1 drachm.
Water,	10 drachms.

These solutions being kept separate. The pyrogallic will keep a considerable time if a drop of nitric acid be added, as recommended by Mr. W. Bedford. Now to develop. Before placing the plate in the dish, rub round the edge a piece of white wax. This is a great preventive to frilling at the edges. Put in a measure, for (say) a cabinet size plate, one ounce of pyrogallic, and add eight or ten drops of the bromide solution, and the same quantity of the ammonia. Pour this over the plate (no previous wetting is necessary). Watch the result, and if the right exposure has been given, the image will come out very slowly; if necessary to hasten the development, and to get the proper intensity, a few more drops of ammonia and bromide may be added, or, if under-exposed, ammonia only. A useful form of dropping-tube, and which I always use, is made by the following method. A piece of quarter-inch-bore glass tube, four inches in length, is held over the flame of a spirit-lamp

Although it is believed that the ferrous-oxalate developer will, erelong, be the one *most* used for the bromo-gelatin plates, still the amount of experience with pyro that has been published by the fraternity abroad, leads to the feeling that it ought to be given a place here. Pyro will, *sometimes*, place a power in your hands when its compeer may not be so

and one end sealed, except a small hole about the size of a pin. Over the other end a small red rubber pipe must be placed, about three inches long. Place a cork in the end, and it is ready for use, and may always remain in the solution ready to hand; by pressing the rubber tube it will take up sufficient liquid, which can be dropped in the exact quantity required by pressing the tube between the finger and thumb. Sometimes I develop with iron, which is conveniently used in the following way: A saturated solution of sulphate of iron, an ditto of oxalate of potash, using four parts of the latter to one of the former; when using the iron I prefer to wet the plate before developing.—Wm. England.

Make two stock solutions, and label them No. 1 and No. 2:

No. 1.—Pyrogallic Acid,	1 ounce.
Glycerin,	1 "
Methylated Alcohol,	6 ounces.

Mix the glycerin and spirit and add to the pyro.

No. 2.—Bromide of Potassium (or Ammonium),	60 grains.
Liquor Ammonia, .880,	1 ounce.
Glycerin,	1 "
Water,	5 ounces.

The above stock solutions will keep any length of time. To make the developer, add one part of No. 1 to fifteen parts of water, and label this bottle D (developer). In another bottle mix one ounce of No. 2 with fifteen ounces of water, and label it A (accelerator). It will be found convenient, to avoid mistakes in the imperfect light of the dark-room, to have these two bottles of different shapes. Either of the above solutions will keep two or three days. When required for use, pour into a clean glass measure equal parts of D and A, adding the A last, just before using. Place the dry, exposed plate face up in a shallow dish or tray, and pour the mixture steadily over the plate, avoiding air-bubbles; should any adhere to the surface of the plate, at once remove them with the finger or a camel's-hair brush kept for the purpose. Rock the dish gently, taking care to keep the plate well covered with the solution. In a few seconds the image will appear, and, if the exposure has been well timed, all the details will be out and the development complete in about one minute, when the negative should be well washed under the tap and placed at once in the fixing-bath. Do not hurry the development, but allow the plate to remain in the solution, after all the details are visible, until the required density is obtained. With this developer used in the above proportions there is no danger of fog, except from the action of light. If on the application of the mixed developer the image flashes out and the details in the shadows appear too quickly, it will indicate that the plate has been over-exposed; therefore at once throw off the mixed developer, and, without stopping to wash the plate, flood it with D alone, when the development will be checked, and will proceed more slowly, while the image gains in density. If too slowly, or the negative appears to be getting too intense, add a very little of A. There will, however, usually be sufficient of the latter left on the plate to complete the development with the simple addition of a sufficient quantity of solution D. A very little experience will enable the

available. It will require the nicest and most thoughtful application and handling, but it will reward you for your care. Mr. Carbutt has reduced its manipulation to a very fine and easy system by his method, given in the notes below, of mixing the ingredients as they are about to be used.

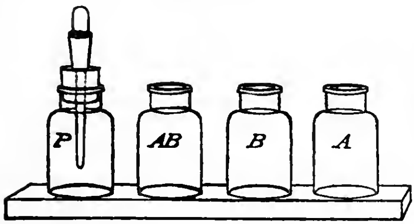
operator to produce a good printing negative from a plate which, if developed with the full proportion of A, would have been utterly useless from over-exposure. (In very warm, bright weather it will, perhaps, be found an advantage to use rather more D than A in the mixed developer, giving just sufficient exposure to avoid hardness in the negative.) Under-exposure can be corrected to a great extent by increasing the proportions of A in the mixed developer, but the addition should be made at once before the development has proceeded too far, or the effect will be to increase the density and cause too much contrast in the negative. The proportions of the mixed developer can be varied at will by the operator, according to the character of the results he wishes to produce.—B. J. EDWARDS.

Pyrogallic acid during the past year has obtained an evil report; and, as it is no longer looked upon as indispensable, there seems some chance of its reputation drifting from bad to worse. Now, it is conceded by nearly all experienced dry-plate workers that alkaline pyrogallic is the most elastic of our developers, and had it not lately acquired a character for producing yellow-brown negatives and stained films, would still be generally preferred. The cause of these troubles is mainly due to a forced and rapid development, produced by a strong alkaline solution, subject to rapid oxidation, and insufficiently restrained. It is a far better plan to build the image gradually, when both color and gradation will be improved to a wonderful extent. In carrying out this method, a four-grained solution of the crystallized neutral sulphite of soda will be found very useful. This is to be used for all operations up to the immersion of the plate in the alum bath before fixing. In hot weather it is valuable also as a reducer of the temperature of water. As an absorber of oxygen it prevents the oxidation of the pyro, and with the sulphate formed it is also a restrainer. The developer thus made is only slightly tinted after the development of a plate, and at the end of many minutes. The sulphite does not seem, however, to have much power in preventing "red and green fog." This effect, when it occurs, is to be found at the margins, and generally in the less exposed parts. No doubt in rocking the dish these portions of the film are more affected by the oxygen of the air, although it would seem that different samples of plates vary much in their liability to this most annoying kind of stain, which may be contracted even when this developer is only tinted by the oxidized pyrogallic. Dilute hydrochloric acid does not seem to have a very energetic action upon the stains. Perchloride of iron acts readily, but there are some objections to its use. It has also a tendency to deposit an insoluble body, in appearance like the hydrate. A very good mixture for removing the color from uniformly stained films—especially when the negative is too dense—will be found in a saturated solution of alum, to every four ounces of which one drachm of hydrochloric acid has been added. This removes the stain, changing the color of the image to a blacker tint, and, when allowed to act for several minutes, reduces the density considerably. Indeed, it might seem to be a better plan to run the risk of getting too much density during the development, than, fearing this, have to resort to intensifying after fixing. This mixture is not a new one, as at first I supposed it might be, for it had been employed to remove pyro stain by others prior to its use occurring to me. As a reducer of the intensity of pyro-developed negatives, it may be new to many.—HERBERT B. BERKELEY.

All these "wrinkles and dodges" in practice come in particularly good now as we are entering this new arena of practice, and if we would have abundant success, we must be on the alert for every sign and signal which comes from those who are more experienced than we, and who are so

I have become convinced that the method of adding the ammonia and bromide by degrees to the pyro is better than adding a nearly or full dose at once, and recommend the return to the use of the dropping-bottle where there is any doubt of the right exposure. To insure the right bottle being in its right place when wanted, I have devised what I call a "developing cruet," and which any one can construct for themselves. I take four one-ounce wide-mouth bottles, such as the iodides and bromides come in, fit them with fine, smooth corks, long enough to enter the neck half an inch, and project about the same; prepare the corks by immersing them in melted paraffin for a few minutes, remove, and wipe off the excess; bore a hole through them that will allow one of the straight glass dropping-tubes, with rubber nipple, to be fitted to each, so as to reach within a quarter of an inch of the bottom, and your dropping-bottles are complete. To insure against their being misplaced when wanted, I arrange them on a base of wood 3 x 9 x ½ inches thick, with countersunk holes one-half inch apart to receive them; cement them in their places either with melted shellac or pitch, or thick varnish; letter each bottle with any black color that will not wash off, with letters to indicate their contents; then screw down the base in a position to be within easy reach of the developing trough. The cut will explain the "cruet" when finished.

FIG. 88.



P contains concentrated pyro solution.

Pyro,	1 ounce.
Glycerin,	1 "
Water,	3 ounces.
Alcohol,	4 "
Wood Naphtha,	1 ounce.

A B contains ammonia and bromide.

Concentrated Ammonia,	1 ounce.
Bromide of Ammonium	60 grains.
Glycerin,	1 ounce.

B contains plain bromine.

Ammonium or Potassium Bromide,	120 grains.
Water,	2 ounces.

A contains plain ammonia.

Concentrated Ammonia,	1 ounce.
Glycerin,	1 "

The dropping-bottle need only be kept about half full for use, replenishing as occasion requires. In a glass-stoppered bottle mix one ounce of P with twenty-one ounces of water, and label pyro developer, which will be about two grains to the ounce. To develop a plate,

generous as to give us the benefit of their experience. Indeed, it is as remarkable as it is commendable, to witness how very enthusiastically this promising process has been worked out to successful results, with the full determination on the part of the industrious ones to give all they know freely to the fraternity. So may it ever be.

say one of 5 x 8 size, measure out three ounces of pyro developer, lay the plate in a shallow, black tray, and pour over it the plain pyro; into the measure drop three drops of A B, return the pyro to the measure and back over the plate; if in fifteen or twenty seconds the image appears, and that slowly, at once drop into the graduate three drops more of A B, and mix the developer with it as before, and return to the plate; if the plate has had the right exposure it will continue to develop with an even pace, and when the shadows are just grayed over, stop developing, rinse off with cold water, and, if temperature is high, place in a saturated solution of alum for from one to two minutes, then rinse and place in a fixing solution of hyposulphite of soda one part, and water six. When fixed, wash for about the same time as for a collodion negative, and again place in the alum solution for five minutes, to eliminate the hypo (I consider the credit is due Mr. John R. Clemons for suggesting the use of alum in photography as an eliminator of hypo); again wash and dry spontaneously. In case of a plate showing no indication of an image in half a minute, then, instead of adding more of A B, add the same number of drops of A, and a further addition if required, till five or six to each ounce of the developer has been added; if this fails to bring out an image, a very rare case indeed, then the plate is under-exposed. Again, over-exposure will be indicated if, on addition of one drop of A B to each ounce of developer, the image starts pretty rapidly in eight to ten seconds, in which case to each ounce of developer in the tray add five drops of P, and one to three drops of B, in one corner, and mix with the developer. These are the check-reins, so to say, to hold in check the over-exposure and permit a good negative to be obtained, that with a large dose of ammonia added at first would have been very difficult to secure. The foregoing mode of development is recommended principally for out-door exposures. For portraiture, where the light is more under control, two or three drops of A B may be added to each ounce of developer before flowing over the plate; and for known short exposure, five drops of A B may be mixed with each ounce of developer before flowing over the plate.—John Carbutt.

I have just tried a modified developer for gelatin plates after a formula given to me by Mr. R. Schlegel, and found it to work so well that I publish it here: Mix one ounce of the strongest liquid ammonia, one ounce of a solution of fifty grains of bromide of potassium in one ounce of water, and one ounce of *eau de javelle* (this is a compound of one part each of chloride of lime and potash in five parts of water); add twenty grains of this solution to a solution of one grain of pyrogallic acid in 400 grains of water. The mixture develops a clear and intense negative, and a little over-exposure will not do so much harm as with other developers. It is now well known that an exposed gelatin plate will give a thinner negative if developed after some time than if developed at once. The latent image will keep for a longer time if the plate be dipped (and kept) in water after exposing. In some cases this may be found useful.—Dr. E. Liesegang.

Should the negative not develop vigorously, the development is forced by increasing the proportion of ammonia, or sometimes that of pyrogallic acid. Though promoting the appearance of the details, this often causes fogging, the negative remaining thin and weak. It

334. If the exposure has been too short, that is to say, if in thirty seconds the high-lights do not yet appear, add drop by drop, and with the greatest precaution a little of the solution A. If the exposure has been too long, that is to say, if the high-lights appear suddenly and before the thirty seconds, add without delay a few drops of the solution B. In order that the addition of this solution B should produce the desired effect, it is necessary that it should be done as soon as the excess of exposure is discovered. In this case the development taking place with the greatest rapidity, it is necessary, in order to save the print, to retard the development from the start. If you wish to give more intensity to the negative, add a few cubic centimeters (one cubic centimeter is equal to sixteen minims) of the solution of pyrogallic acid No. 1. Now finish as just explained after the iron development. Thus with pyrogallic acid it is possible, and this is of very great importance, to correct the excess or the insufficiency of exposure. To reach the same result with iron, it is necessary to operate in the following manner: If the exposure has lasted any too long, as soon as you perceive it, add at once a few drops of bromide

may be remedied by increasing the quantity of potassium bromide in the same ratio as that of ammonia, thus ultimately correcting defects due to errors of exposure or faults in the emulsion. A milky veil is sometimes seen when the ferrous-oxalate developer is employed. It is due to a precipitate of oxalate of lime formed by the oxalic acid of the developer coming into contact with the lime of the hard spring water in which the plates have been washed. With the pyrogallic developer this chalky precipitate does not occur, even when spring water is used, for caustic ammonia only precipitates lime after a lapse of some time. It is, however, always preferable to use distilled water for the purpose of washing—or, at least, rain water. As a remedy against solarization, avoid as much as possible too great contrasts in the image to be produced; place the camera so that no reflection of light can penetrate the objective; do not prolong the exposure more than necessary; stop the development as soon as possible, and blacken the interior of the dark slide and the back of the plate.—W. P. Bolton.

334. I name the ingredients of an intensifying solution which I have found exceedingly useful in my hands. There is nothing new about it, save in the combination of the chemicals, so far as I am aware; but there is great latitude in their use, and by varying the proportions wide diversity of effects may be produced. It is needless to give proportions. I therefore leave the reader to experiment, and find them to suit himself—now more of this and less of that—as circumstances may demand. Take bichloride of mercury, iodide of potassium, and cyanide of potassium, and mix with intelligence. With these three old-fashioned agents capital results may be got, and the solution may be used again and again till exhausted. I reduce over-intensity with chloride of copper, cautiously followed by ammonia; but the less there is to reduce the better. It will be found that a surface deposit takes place upon most negatives when intensified, but this is easily removed by a gentle rubbing with the finger or a soft brush. This may be done also with advantage after all washings.—G. G. Mitchell.

of ammonium at ten per cent. If the exposure has been too short, add to the developer, as soon as possible, the half or the whole of its volume of ordinary water, then continue the development until all the details have appeared. This large addition of water, which at first sight may appear rather strange, does certainly retard the development in a slight degree, but not as much as might be supposed before making the experiment. However, it is absolutely necessary in order to prevent the hardening of the lights and to preserve all the harmony of the negative. If you wish, during the development, to increase the intensity of the negative, as you have done in the case of the pyrogallic acid, add to the developer some more of the iron bath with a little of the bromide of ammonium. The same result is obtained, as has been said, by Mr. Kennett, in making this addition to the hyposulphite bath; but the trouble resulting from this in the fixing solution renders the first method preferable. To end this very important question of development, please let it be said that a concentrated solution of bisulphide of soda, which has remained for fifteen minutes in granulated zinc, and to which has been added after

Since the adoption of the gelatin process in lieu of collodion, one of the troubles which, when it occurred, has been the most difficult to cure, has been the occasional production of too intense a negative. I have now to offer a remedy which I have found thoroughly effective, reducing in an even manner, and without destroying the half-tones, a negative which had resisted even strong cyanide. The agent I employ is "Holmes' Ozone Bleach"—an article sold for laundry and disinfectant purposes at eightpence per quart bottle. I use this diluted with about four times its bulk of water in a dish; greater or less strength may, of course, be used as desired. If to bring down locally any particular part of the negative, a little of the undiluted liquid may be poured on the plate already swilled with the weaker solution; but in this case the tap must be handy to stop the action quickly when wanted. The same solution (perhaps more diluted) may be used to discharge the last trace of hypo from the plate for those who prefer to intensify with silver and pyro.—W. E. Debenham.

The thorough elimination of hyposulphite of soda from gelatin negatives ought to be done with a great deal more care than is generally the case, and many good negatives are lost through inattention to this important point. The negatives, after having been thoroughly rinsed under the tap, ought to be laid, face down, in a dish, or, what is better, a zinc trough made with sloping sides, the bottom being narrower than the top. A small hole near the bottom of one side will let out the water, which should be run in from a tap in a constant stream for an hour or two upon the negatives. The outlet should, of course, be less than the inflow in order to keep the trough full and covering the negatives. Having been annoyed by the long time my gelatin negatives took to dry, I hit upon the following plan by which they may be thoroughly dried in a few hours. It is simply to set the negatives in sunshine, and with a good breeze it will be found that they dry thus both quickly and well. Care must, however, be taken to guard against rain falling on the half-dried plates, which, if it occur, would completely spoil them.—John Jackson.

filtration a small quantity of pyrogallic acid in crystals, forms an excellent developer for gelatino-bromide plates. The use of granulated zinc is not indispensable.

The beginner will doubtless find this developer very convenient, as it dispenses with the use of ammonia, which is rather difficult to use; but when he shall have acquired more experience, he will not hesitate, in order to increase the intensity and correct the exposure, to have recourse to the two drop-bottles of ammonia and bromide already recommended for the alkaline development. Beer, used in the proportions of one-fourth or one-half, in the developer produces results rather remarkable and analogous to those of the bromide; it gives brilliancy and intensity to the negative, but retards slightly the development. The sucrate of lime, recommended by Mr. Davanne, added in small quantity either to the iron or to the pyrogallic acid, gives nearly the same results as the bromide and the beer, but appears to have over these two substances the advantage of not retarding the development. When used, it is necessary to filter the developer after it has been added to it.

335. Retouching and Varnishing.—Ordinarily, the plate, well treated as I have just indicated, and especially when placed in the ten per cent. alum solution, may be readily retouched without using gum. If, however, the pencil should not take on certain portions, they should be lightly rubbed with a small tuft very slightly moistened with the liquid used for retouching varnish. The negative, well retouched, entirely finished, and perfectly dry, is varnished in the usual manner after slightly heating.

336. Printing the Positive.—The gelatin negative being more opaque

335. Next to good gelatin plates is a good varnish to protect them from the weather. Damp is known to spoil them quickly, and a varnish that has the following qualities is a good one: First, that it shall perfectly protect the gelatin film from damp; secondly, that it will not become tacky and stick to the printing paper in the hottest sun; and, lastly, that it can be removed without danger to the film, if it be required to strengthen a negative that is considered to be too weak after varnishing. The formula I give below will do all these.

Take methylated spirit thirty ounces, place it in a stone bottle and add one ounce of shellac; then place the bottle in hot water for fifteen minutes, and well shake. Next add gum-sandarac two and a half ounces, well powdered, and gum-benzoin two ounces. Shake well at different times for a few minutes, and let stand a day. Then filter, and it will be found to make a varnish that will flow well and possess the qualities I have described.—George Willis.

336. Print farther or darker than wet plates, and do not tone so far as prints from wet plates. My printing-bath is as follows: Silver, sixty grains to one ounce of water; to this add nitrate of ammonia until the solution indicates eighty grains; make the bath slightly acid in cold weather; float from one and a half to two minutes; fume forty minutes.

than the collodion negative, in order to judge finally the degree of intensity necessary to give it to obtain a good positive print, it is indispensable to make some previous trials on paper. A good gelatin negative, like one made with collodion, should be brilliant, rich in details, full of relief, very strong, but at the same time the lights should be transparent. The gelatin process lends itself marvellously to obtaining a negative which certainly could not be produced with the same qualities by the wet-collodion process. For printing the negative, it is necessary to use the customary precautions and means to retard or increase the action of light on those portions of the negative that might require them.

337. Although the instructions so far given are rather lengthy, it may be necessary to render them still more complete by adding the following remarks, the importance of which will certainly not escape those who have already practised this new process. For gelatin work, we may, in fact it is even necessary, use more light than is generally done. It is essential, to make good work, to see very clearly what is being done. The fog which sometimes occurs, does not arise, as much as it is supposed, from

My toning-bath consists of acetate of soda, one hundred and twenty grains; nitrate of uranium, fifteen grains; water, sixteen ounces; neutralize gold one grain to an ounce of water; also neutralize the uranium.

It has been stated that dry plates would not stand the heated term of the summer season. I can certify that they will stand the heat, as I have tested the same to my entire satisfaction, having exposed them with the thermometer at 104° in the shade, and they developed perfectly clear, and where a wet plate would dry and fog from the heat.—C. F. Moelke.

337. Fogging invariably makes its appearance when the emulsion is prepared with an excess of silver nitrate. Many kinds of gelatin are liable to give fog when they have an alkaline reaction. Fogging is also caused by continuous digesting at too high a temperature, by the addition of too much ammonia, or by too long or too great heating with the same substance. It may be cured by adding bromide of potassium or a few drops of the tincture of iodine. Emulsions which are inclined to fog are best cured by being washed first with a dilute solution of bichromate and then with water. Due attention must be paid to the mixing of the ingredients in the required proportions, and at the proper temperature. By the addition of ten per cent. of alcohol, the bromide of silver is brought to a pale condition. In employing bromide of potassium it must be chemically pure; by using it in excess of the silver, a much more sensitive emulsion ensues. As to the quantity of gelatin in the more fluid emulsions, the bromide of silver is granulous and green, and, unless care be taken, likely to separate out, while with a larger amount of gelatin it is finer and paler. With regard to the quality of gelatins, those of Nelson's are the purest, although not so firm as others—Swinburne's, and those of French and German manufacture, for instance. Imperfect washing often gives hard, impure negatives, while thorough and continuous washing greatly improves the emulsion.—Dr. D. Von Monckhoven.

an excess of light in the dark-room. The important point is that this light should be of a particular nature. It should be of a decided red, or ruby color. To avoid fog, the attention of the photographer should be directed especially to the choice of a good emulsion, to the careful examination of his chemicals, to his camera, and principally to his holders, into which the least trace of light should not penetrate. It is well understood that this applies also to the dark-room. A large black cover over the tube of the objective, the camera, and the frame, is also indispensable, especially for outside work. The operator should not forget, also, when developing, to measure the quantity of bromide by the sensitiveness of the emulsion and the time of the exposure.

338. Nelson's gelatin No. 1 appears to be the best for making the emulsion, but in summer especially it is well to add to it a firmer gelatin which sets more readily; several French gelatins possess this quality. The addition of fish-glue presents also certain advantages; it gives more permeability to the film, more sharpness, and a more agreeable color to the negative. To obtain a good emulsion easy to follow by transparency during development, the coating should not be too thick, and the weight of the gelatin should be the three-fourths of that of the bromide of silver. For easy manipulation, the best proportion to observe between the bromide and the silver is that of two to three.

339. In the manufacture of the emulsion, sufficient importance is not given to the kind of bromide used. All bromides do not give the same

339. A few hints: Should there be any signs of frilling at any stage of developing or fixing, which will rarely or never be the case with these plates, flood the plate with a saturated solution of alum, wash well, and proceed. Trays for developing may be made of ordinary back-board, nailed with small finish nails, and covered inside and out with a composition made by melting together equal parts of yellow beeswax and common rosin. Trays and measures should be rinsed out after developing each plate. Care must be taken to wash the plate very free from the hypo, and for this purpose it is well to immerse the plate for a few minutes in a saturated solution of alum, after the washing, which will decompose any hypo remaining. The following is a better mode of intensifying: Flow the plate with a twenty-grain solution of bichloride of mercury till the intensity appears right; wash well and flow with ammonia, about one part to ten of water. Repeat, if necessary, with thorough washing. A yellow or brown discoloration of the film under the mercury indicates the presence of hypo. Alum has been much used in working gelatin plates, but hitherto simply to harden the film and prevent frilling. But recently it has been found that alum removed the traces of hypo which appear to escape the usual washing. It is therefore well to immerse the plate in a saturated solution of alum, after fixing and washing well. The *British Journal* advocates intensifying with silver and pyro after the use of the alum; but it is best not

effects. The most rapid and the best seems to be that of ammonium; but used alone, it has sometimes a tendency to produce gray prints. Bromide of zinc has precisely the opposite qualities. Bromide of lithium gives a certain adherence to the film, and the bromide composed of potassium, cadmium, and zinc, used by Mr. Chardon in the collodion emulsion, gives to the gelatin negative, specially when developed with pyrogallic acid, a very rich tone; strengthened by bichloride of mercury and cyanide of silver, it produces results of remarkable beauty.

340. Transparencies for lantern use, collodion transfers, and other enlarging processes, are rapidly and easily made by the bromo-gelatin pro-

to be too sanguine of silver intensification even after alum, as the mercury and ammonia method is simple, and gives permanent results, and there is at least a liability of the silver combining with the gelatin and bringing about a gradual discoloration.—C. F. Richardson.

Be very careful as to any actinic light in your dark-room, and use a ruby-colored lantern or lamp (the top well covered with a dark tinned cone), if necessary. Before putting away the negative to dry, place the plate in a dish of water, film down, one end raised, and allow to soak for half an hour, and, lastly, rub with a tuft of cotton to remove any sand or sediment that may have remained on the film. Should you desire to dry the plate quickly, soak in alcohol from ten to fifteen minutes, and set aside to dry. Heat may be employed in varnishing the negative, which must be perfectly dry. Make a proof-print before varnishing, to see that the negative is of proper strength. Keep your hands free from hypo while developing, or fog will be the result. If your negatives have too much contrast, weaken the developer by adding water. Over-exposure is preferable to under-exposure, and we invariably recommend a second sitting where the latter has occurred. Keep your solutions cool, as heat, while the plate is moist, will dissolve the film. The strengthening, reducing, fixing, and alum solutions can be repeatedly used, but require changing when they become too much discolored.—F. W. Guerin.

340. For a dense gelatin emulsion suitable for printing transparencies, the following formula has given me better results than any I have yet tried, and I give it in the hope that it may be useful to others who are engaged in this class of work. Formula for three ounces of emulsion:

Bromide of Potassium,	44 grains.
Iodide of Potassium,	1 grain.
Nitrate of Silver,	60 grains.
Nelson's No. 1 Gelatin,	70 "
Dilute Nitric Acid,	5 drops.
Beer,	1 drachm.
Strong Ammonia,	15 drops.

The beer in the above formula is composed of four ounces of ordinary bitter beer with two ounces of alcohol added to make it keep, and the dilute nitric acid by adding one drachm of strong nitric acid to one ounce of distilled water. To make the emulsion, place the bromide and iodide in a beaker of suitable size, and then add one drachm of beer, three drachms of water, and ten grains of gelatin. Now weigh sixty grains of gelatin and completely immerse it in any vessel of cold water; let it remain for two or three minutes (not longer, or it would absorb too much water), and then turn it out on to a hair sieve to drain.

cess. The film being so delicately soft and structureless makes them particularly beautiful and desirable. The preparation of the emulsion for such work must be attended with unusual care as to material and temperature. But if good results are desirable, then all the care they need to produce them is reasonable.

By the time this has been done the gelatin and bromide in the beaker will be ready to dissolve. To effect this take a tin saucepan or can of about the capacity of one quart; fill it two-thirds full with water, and in this place the beaker, which must have something put for it to rest upon in order that it may not sink too deeply in the water. Now place the saucepan over a Bunsen burner, or even on an ordinary fire, and raise the temperature of the water to 140° F. Whilst this is being done weigh out the silver, dissolve it in half an ounce of distilled water, and add five drops of diluted nitric acid. When the water in the saucepan has reached the required temperature remove it from the gas, and then add the silver solution to the bromized gelatin. This can be best effected by one of the well-known spray producers, and as this is a little contrivance that any one may easily make for himself, the operator will do well to provide himself with one. Should, however, one of these be not at hand, a dropping-tube will do nearly as well. In either case the silver must be added a little at a time with constant stirring, and for stirring, a flat slip of glass from half to three-quarters of an inch broad will be found better than a round rod. When all the silver has been added the pan must be again put over the gas and the water brought to boiling-point. This will take about five minutes, and during this time the emulsion must be pretty constantly stirred. As soon as the water boils, the gas may be put out and the pan removed. Now add the remaining sixty grains of gelatin, stir for half a minute, and then drop in, with constant stirring, fifteen drops of strong ammonia. After this the emulsion must be immediately poured into a six- or eight-ounce bottle and be thoroughly shaken. Now pour cold water very carefully into the pan until the thermometer registers 140°. It is a matter of the greatest importance that the temperature be nicely regulated at this point, because if higher than that stated fog is pretty sure to be the result, and if much lower the emulsion will probably be very slow. The bottle of emulsion must then be returned to the warm water and set aside for an hour or longer to cool gradually. If the bottle be enclosed in a canister with a perforated bottom, it will be found a great convenience, as light may then be admitted into the operating-room without any fear of its injuring the emulsion. At the expiration of an hour or an hour and a half the temperature will have sunk to 80°. If it have not done so a little cold water may be poured into the pan until the thermometer registers that degree, or even a little lower. The emulsion must be left for ten minutes longer, and then it will be ready for the next operation, viz., the removal of the soluble salts. This may be most conveniently effected by precipitating it in alcohol. To succeed in this operation, three points should be particularly attended to: 1. The emulsion must be tolerably concentrated; that is to say, no more water than necessary should have been used in its composition. 2. The temperature must be low. 3. The alcohol must not be used too sparingly. The temperature, then, having sunk sufficiently low, put five ounces of methylated alcohol into a glass beaker, and into this pour the emulsion in a thin, continuous stream, stirring at the same time with a round glass rod. When all has been poured in stir a few moments longer, pressing the rod against the sides and bottom of the beaker, and the emulsion will then be found to have collected as a compact mass round the end of the stirring-rod, from which it

341. It will be seen that in all the preceding instructions in this lesson, the utmost diligence must be exercised in securing the entire absence of white-light during the preparation of the plates and their manipulation. Light may be admitted in any quantity, but it must be of a quality of color that is harmless. This may be arranged by pasting ruby-colored

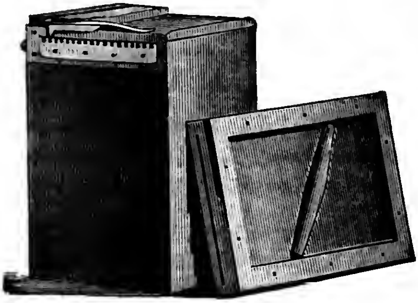
may be detached in the following manner: Grasp the rod just above the emulsion with the thumb and forefinger of the left hand, and with the right hand twist the rod round, at the same time pulling upwards. The emulsion will thus be readily forced off the rod. Now take it (the emulsion) between the fingers and thumbs of both hands, press out of it as much alcohol as possible, rinse it with a little fresh alcohol, and the operation will now be completed. In case it is desired to keep the consolidated emulsion for any length of time, it should be put at once into a bottle in order that it may keep moist, because after it has once been allowed to become quite dry there seems to be considerable difficulty in redissolving it. When required for use, with a clean pair of scissors cut up the cake of emulsion into thin sliçes, letting these fall as they are cut into a beaker filled with cold water, in which they must be allowed to remain an hour (or longer if convenient), after which pour off the water, fill up with fresh, let stand for a short time, and then drain off this also. Now place the beaker in water heated to about 130°. Let it stand in this for ten minutes, then add as much water as may be required to make up the quantity to three ounces, stir well, filter, and the emulsion will be ready to coat the plates. It is quite essential that plates prepared with emulsion made as above directed should be developed with ferrous oxalate, as they are very subject to green fog when the alkaline developer is used. As regards exposure, I find that at two feet from an ordinary No. 8 gas-burner the time required is about three seconds. Though I consider these plates better adapted to printing than to anything else, still they will be found by no means bad for any purpose where great speed is not required, and where the oxalate development is admissible.—H. HOULGRAVE.

341. After a series of experiments I came to the conclusion that, if two non-actinic media were placed in close contact, there would be a less perfect light filtration (if I may so term it) than if the planes or intercepting surfaces of (say) the glass or paper were separated by a small intervening space. It seems to act almost like a "double filtration," the actinic rays being neutralized far more effectually than if the same media were placed in immediate contact. Another simple wrinkle which no one should miss is "to grind one side of your ruby or orange glass." This softens or mellows the light and prevents any direct flare from the flame reaching the plate. When developing, I have found this a sure cure for light fog, when caused by the lantern. If you want to improve the illumination, after grinding the surface of the glass rub over the ground side a little grease. A little emery or pumice powder rubbed on the glass will soon obtain a ground or mat surface. My next hint on lanterns will, I think, be rather novel in character. It is nothing more nor less than, instead of using glass or paper for the non-actinic medium, to adopt a "colored" liquid to pass the light through. This has the following advantages: You can weaken or strengthen it to any depth of tint; also, any thickness or volume of colored medium can be used to meet the requirements of your sensitive plates. Non-actinic glass cannot be met with except of a thin kind, but by my method you can have density from one-eighth of an inch upwards. With this power available, the chance of fogged plates from unsuitable "light" vanishes. This principle can be easily applied to any form of lantern, as the cell containing the colored

paper over the glass of the dark-room, or by the use of a lamp or lantern protected properly by ruby-colored glass or paper.

342. A few words as to the apparatus needed for this interesting process for work outside, and then it must be left to grow, and grow as it surely will, into public favor. In the Lesson B, the camera-box is described, so that here allusion need only be made to the double holders and the changing-box, either of which may be used to suit the inclinations of the operator. Of the latter first. The annexed diagram represents what is known as "the old-fashioned dry-plate changing-box." It is often used instead of the double holders. The

Fig. 89.



liquid is simply adapted for the lantern in the form of a slide, grooves being provided to receive the slide; and this answers also in place of a hinged door. I find the illumination of two sides of the lantern sufficient, and this I place angle-wise in front of me when at work. A small hinged hood of tin will be found useful for protecting the eyes and keeping the light on its work. This is, of course, fastened to the top of the slide, and when in use acts like a sloping awning over the illuminated surface of glass, and ought to be fixed to all lanterns, as it effectually prevents any upward rays of light. To make the slide, get two pieces of clear glass of equal size, and about one and a half inches larger than the lighting surface of your proposed lantern. Get some strips of glass or wood, about three-eighths of an inch wide, and of any thickness you may require your fluid chamber. I use three-eighths of an inch. Now take the strips of glass and cement them round three sides of one sheet and along the fourth side; also cement a strip, but leaving an opening of half or three quarters of an inch. When all is set firm, with a brush lay cement over the strips so fastened, and then press the remaining sheet of glass on the top of the same. This completes a glass box, as it were, a hole being left at one corner edge between the sheets of glass for pouring in the liquid. When all is again set, work a little marine glue round the edges, and then bed the whole in a rebated wooden frame, still leaving the corner hole. This forms your glass screen complete. If the lantern grooves are made wide enough to receive two screens, you can fill one with orange and the other with ruby solution, and can use them either separately or together, or neither. When non-actinic light is not required, simply drop the slide into the lamp grooves in the same manner as when inserting the slide in the back of the camera.—W. Clement Williams.

Fig. 90.

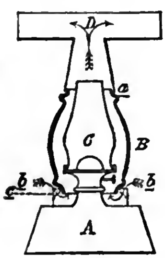


Fig. 90 is a sketch of a lantern for the dark-room. A, lamp; B, ruby globe; C, white common chimney; D, tin chimney; *a*, plaster of Paris joint; *b*, annular space for draught; *c*, tin collar to support globe. There seems to be a

plates are put in a grooved box necessarily heavy, supplied with an automatic slide which opens as the holder is drawn through a slot in the box. Then the box is turned upside down, and the plate falling into the holder is there made fast, ready for exposure. Upon the holder being withdrawn, the slot is closed, and the plates remaining in the changing-box are protected from light. Sometimes such a method is a bothersome one. Should the plate be a trifle large, it will not come out from the box, or enter the holder, and then has to be passed over, no matter how much shaking and display of temper is given in the effort to make it work right. The second figure represents the changing-box as arranged when about to receive or discharge a plate. The brass registering plate at the side is numbered so that account can always be made of the plate which has been exposed.

FIG. 91.

343. The double dark-slide, patented by the American Optical Company, seems very superior to the changing-box, being lighter, surer, and enabling one to duplicate negatives quickly in case the circumstances are favorable, without having to run to the changing-box, drop one plate and receive another, thus wasting the time when the light is in its most charming condition. The double holder is described in the *Photographic Times* as follows:

"As in the original slide, the plates are inserted by means of a groove —in this instance in the bottom. Instead, however, of both plates being placed back to back with a piece of springy paper between them, and then inserted in the wide central aperture fitted to receive them, there is a separate groove for each plate with an extra groove between them.

general want of a proper lamp to develop dry plates by, and the above plan is simple, safe, and any tinsmith can make it. All that is required is the ruby globe; those used by railroad companies, if deep color, are just the thing. If we could be supplied with such a lamp, or a better one, by the dealers, I think it would greatly aid dry-plate workers.—GEORGE EASTMAN.

TABLE FOR THE SIMPLIFICATION OF EMULSION CALCULATIONS.—With a view of simplifying the calculations involved in emulsion making, Mr. William Ackland has worked out a useful table which will enable even those most ignorant of chemical philosophy to calculate with ease and rapidity the proper quantities of silver or haloid salts in any formula. Even those who are able to perform the calculations in the recognized style, will

When the end is opened ready for the reception of the plates it looks for all the world like a plate-box containing accommodation for only three plates. The two outer grooves disclosed to view are, of course, for the

find their labors materially lightened by means of this table, which should be kept in a convenient place for reference in every laboratory.

	Equivalents.	Weight of $AgNO_3$ required to convert one grain of soluble haloid.	Weight of soluble haloid required to convert one grain $AgNO_3$	Weight of *silver* haloid produced by one grain of *soluble* haloid.	Weight of *soluble* haloid required to produce one grain of *silver* haloid.	Weight of silver haloid produced from one grain $AgNO_3$
Ammonium Bromide, . . .	98	1.734	.576	1.918	.521	
Potassium " . . .	119.1	1.427	.700	1.578	.633	
Sodium " . . .	103	1.650	.606	1.825	.548	
Cadmium " . com.	344*	.988	1.012	1.093	.915	1.106
" " . anh.	272*	1.25	.800	1.382	.723	
Zinc " . . .	225.2*	1.509	.663	1.670	.600	
Ammonium Chloride, . . .	53.5	3.177	.315	2.682	.373	.844
Sodium " . . .	58.5	2.906	.344	2.453	.408	
Ammonium Iodide, . . .	145	1.172	.853	1.620	.617	
Potassium " . . .	166.1	1.023	.977	1.415	.707	1.382
Sodium " . . .	150	1.133	.882	1.566	.638	
Cadmium " . . .	366*	.929	1.076	1.284	.778	

* These salts combine with two equivalents of silver nitrate, so that practically the real equivalent is one-half that given.

The principal bromides, chlorides, and iodides which are likely to be used in emulsions of either gelatin or collodion have been included in this table. This table presents to the reader, without any mystification which may be involved in equivalents, the actual weights of haloid or silver, as the case may be, required to convert or combine with one grain of the other. In order to test the utility of this table, let us suppose that it is desired to make, say, ten ounces of emulsion by a new formula, which, for the sake of showing the working of the table, we will write down as follows:

Bromide of Potassium,	150 grains.
Iodide of Potassium,	10 "
Chloride of Ammonium,	10 "
Gelatin,	200 "

Now we want to know how much silver nitrate should be employed in sensitizing this mixture. For this purpose we use the first column, in which we find against each haloid the exact quantity of silver nitrate required to fully decompose one grain. Taking, then, the figures we find in column No. 1 against the three salts in the above formula, and multiplying them by the number of grains of each used, we have the following sum:

Potassium Bromide,	$150 \times 1.427 = 214$	Weight of silver nitrate required.
Potassium Iodide,	$10 \times 1.023 = 10.23$	
Chloride of Ammonium,	$10 \times 3.177 = 31.77$	

or the total quantity of nitrate of silver required for full conversion, 256.00 grains.

W. P. Bolton.

reception of the plates, which are inserted face out. In the central groove is inserted a slab of blackened wood, on each side of which is a thin brass spring, which, pressing against the backs of the plates, keeps them firm against the face of their respective grooves, the wooden partition itself effectually preventing the transmission of light from one side to the other. This partition is finished off with a thick solid piece of wood nearly the width and thickness of the whole slide, the fitting of it being such as to cause it to block up in a perfectly light-tight manner the aperture through which the plates were admitted. In short, by the insertion of this central partition, the plates are rigidly held in their places and rendered absolutely secure from the admission of even the faintest trace of light. It contains five grooves, the two outer ones being for the sliding shutters, which may be formed of zinc, ebonite, or, as in the American one, a hard-pressed varnished sheet of card, or, rather, a very highly-calendered Manila board. These outer grooves are very thin, being only sufficient to permit the shutter to slide easily. The three others are respectively for the two plates and the central partition already described. When exposing, the shutter is pulled entirely out and is quite detached from the slide, there being a "cut-off" automatically thrown into action by which the aperture through which the shutter was withdrawn is instantaneously closed against the light. The above engravings will render still plainer, if possible, the verbal description just given. The grooves for both the sensitive plates and the central partition are shown at (B C B) in the end view (A), Fig. 92, of the holder. In the central groove (C) is inserted the partition (D), Fig. 93, with its side springs. This partition is so arranged that not a particle of light reaches the plate after it has been pushed into position. In Fig. 94 is shown the holder (F) with shutters (I I) partly drawn, and showing the end (G) in which the plates and divisional partition are inserted. The above engravings represent the dark slide to be much thicker than it is in reality."

FIG. 92.

FIG. 93.

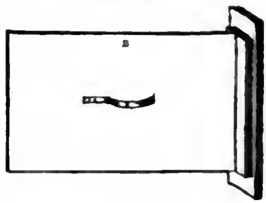
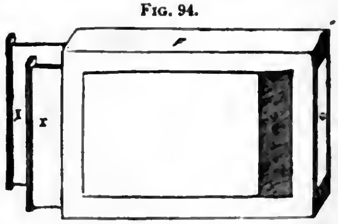


FIG. 94.



LESSON V.

VOGEL'S COLLODION EMULSION.

344. With all its advantages, the bromo-gelatin process is not entirely *all* that is wanted to take the place of the "wet" or bath method of working, and the inventive portion of the craft is still on the search for something better. This, Dr. H. W. Vogel, the well-known German scientist, claims to have found, and provides an emulsion which photographers can use for coating their plates, and expose it "wet" or "dry," but always discarding the use of the bath. His process of manufacturing the emulsion is patented, and consists in forming a homogeneous mixture con-

344. Preliminary Preparation of the Plates.—The glass plates require a coating in order to make the emulsion adhere quite fast, and for this purpose a solution of caoutchouc or chrome gelatin is used. A. *Coating with Caoutchouc.*—Pour twenty-five grammes chloroform over one gramme soft, brown caoutchouc; let the whole stand quiet two or three days, stirring it occasionally, and dilute the solution with eight times its volume of light benzine, and filter through cotton. The solution keeps for months. With it the cleaned and dusted plates are coated the same as with collodion; the coating dries in five minutes. The drainings must not be poured back into the original bottle, but caught in a separate bottle, to be diluted afterwards with one-eighth benzine and filtered, before ready again for use. B. *Coating with Chrome Gelatin.*—Dissolve one gramme of gelatin in 300 grammes of warm water, filter, and after washing add six cubic centimeters of a filtered solution of chrome alum, 1 : 50. The solution keeps from four to six days. The plates are acidulated, washed very thoroughly under rubbing, and then placed in a cup with distilled filtered water. They are then taken out one by one, a portion of the solution of gelatin is poured on and allowed to flow over the whole surface, when the excess is drained off. (These drainings are *not* used again.) The first affusion drives off the water, and after the same has drained off another coating is poured on, and the plates are placed in a vertical position for draining and drying. In not too cold temperature, they will be dry inside of an hour. In winter, the gelatinizing is done in a warm place, as cold plates do not take the gelatin easily.

The Pouring on of the Emulsion.—Place the bottle containing the emulsion in warm water of about 40° R., until the emulsion, which sometimes congeals in the cold, becomes thoroughly liquid, and then pour it on like collodion. The substance flows and evaporates somewhat slower than collodion, so that no fears of drying need be entertained in pouring on. The plate may be balanced in the hand, so as to help to produce an equal coating.

While the excess is drained off, rock the plate, but slower than with collodion. When the last drop gathered on the corner begins to congeal, place the plate in a vertical position

taining bromide of silver, or its equivalent, with pyroxyline, which consists in first producing the gelatin emulsion in the usual way and drying the same, then dissolving it in an organic acid and mixing the solution with pyroxylin also dissolved in an organic acid. Thus it will be seen we have a collodion emulsion, so to speak, which must be difficult to prepare. But, since it is in the market and destined to become a

to dry. The drainings are caught in separate bottles. The preparation takes place in the dark-room, with red light. For draining-bottles, collodion bottles covered with brown paper are recommended. The beginner may meet, perhaps, some difficulties at first, but after one or two experiments he will become quite an expert. In winter, a well-warmed room is indispensable.

THE EXPOSURE.—For exposure, light-proof cameras and boxes are required, also protection of the objective from lateral side-light. Time of exposure about one-third of the time necessary for wet iodine-collodion plates. Exposed wet, the emulsion plates are a trifle less sensitive than when exposed dry.

DEVELOPING.—For this stage of the manipulation, the simple alkaline pyrogallic developer is best adapted, but it is necessary to modify the same according to the temperature and character of the plate. For a *carte-de-visite* plate, 5 x 8 inches, take

Solution of Bromide of Potassium, 1:10,	1½ to 2 c. c.
Solution of Pyrogallic Acid in Alcohol, 1:10,	2 "
Water,	100 "

Add five or six drops of ammonia, pour the mixture in a cup, and place the plate in it, with subdued light. If the plate has been exposed wet, it must be previously placed in a cup of water from three to five minutes, and rinsed somewhat, then it is placed in the above-mentioned developer, which may contain one or two drops more of ammonia than stated above. With a dry plate, an equal flowing over of the developer is of importance, in order to avoid streaks. If the plates incline to form fog, which occurs oftener in high than in low temperature, the addition of bromide of potassium is increased; the same in case of over-exposure. When stronger intensity is desired, take double the quantitity of pyrogallic acid, as stated above, and nine or ten drops of ammonia. The picture develops gradually, and its intensity increases more and more. An addition of one drop of ammonia more helps the development. The ferrous-oxalate developer of Dr. Eder can be used when eight drops of bromide of potassium (1:10) to one hundred cubic centimeters developer are added, but it is liable to work hard. Also the prussiate of potash developer

Yellow Prussiate of Potash Solution, 1:4,	50 c. c.
Water,	50 "
Pyrogallic Alcohol, 1:10,	5 "
Ammonia,	12 drops,

can be used, but in most cases the pure pyrogallic acid developer is preferable.

THE FIXING takes place just as rapidly as the fixing of a collodion plate. The plate is put in a solution of hyposulphite of soda, 1:5. In a few minutes it is fixed. Minute yellow dots, which may, perhaps, remain in it, are nothing but bromide of silver left, which is easily dissolved in continued fixing. After fixing, the film is washed (not longer than a

popular candidate for favor, full directions are given below for its use. The advantages claimed by the inventor are its keeping qualities, and the ease with which it can be worked. The plates are coated just as collodion plates are, and may be intensified, fixed, washed, and dried with no more labor. Hence, any photographer may prepare his own plates economically, if the directions in the notes are faithfully adhered to. They are given as received from Dr. Vogel.

collodion plate). It adheres to the plate better than the gelatin emulsion. Treatment with alum is unnecessary.

INTENSIFYING is necessary only in exceptional cases. The following mixture is used for it:

Solution of Iodide of Potassium, 1:10, ...	5 c. c.
Solution of Bichloride of Mercury, 1:50, ...	5 "
Water, ...	10 "

This solution is poured upon the fixed and carefully washed plate until the surface of the same shows a distinct greenish-gray color. Afterwards rinse carefully with water. Other intensifiers, even the silver intensifier, may be used with these plates, but the iodide of mercury intensifier is the best; care has to be taken not to let it act too long. The action continues even during the washing. Less rapid, but surer, works Edwards' intensifier, as follows:

a Chloride of Mercury, 1:50.
b Iodide of Potassium, 1:10.
c Fixing Soda, 1:8.

And twenty cubic centimeters *a* are mixed with six and a half cubic centimeters *b*, and six and a half cubic centimeters *c*. This intensifier can be used also upon the imperfectly washed fixed plate without danger.

DRYING AND VARNISHING.—The plates dry spontaneously in a few minutes; the varnishing is the same as with a collodion plate. A previous coating with gum and similar substances is only to be used when the glass plates have not been coated with caoutchouc, but are gelatinized.

THE RE-EMPLOYMENT OF THE DRAININGS.—The emulsion drained from the plate can be used again after having been filtered. Dilute with one-tenth of its volume of a mixture of three-fourths alcohol with one-fourth acetic acid, and filter warm, either through shirting—which has previously been boiled several times in water, in order to get rid of the starch, and dried again—or through a funnel, in the neck of which clean cotton is placed. The latter is rammed tight with a glass rod, which is left sticking in the funnel. Then moisten with the above-mentioned alcohol and acetic acid mixture, and pour on the drainings. By pressure with the glass rod, the filtering can be regulated.

CAUTIONARY RULES.—Water precipitates the emulsion, therefore care must be taken to avoid letting drops of water get on the plate which is to be prepared. The vessels for measuring and keeping the emulsion must be perfectly dry. Upon old caoutchouc coatings the emulsion does not adhere as tightly as upon fresh ones. The gelatin coating, however, can be used after months, if it is protected against dust. The rough margins of the plate have to be cleaned thoroughly.

LESSON W.

ENLARGEMENTS AND LANTERN SLIDES.

345. SOLAR-CAMERA printing is used only as a means of making enlarged pictures and is not adapted for small work, owing to the coarseness of the results and the slowness of their production. The negative to be used for this purpose should not be so dense as one intended for contact printing, and in manipulating it all harsh, hard shadows should be remedied. A thin, even-flowing collodion should be used, plenty of exposure given, and rather slow, weak development practised. The negative should not be varnished. There are two forms of solar camera used—one known as the "reflecting" and the other as the "direct printing." They are composed of an objective, a condenser, and a dark-chamber, in

345. Negatives well adapted to solar enlargements should be full of detail in the shadows, but thin; and should, as seen by transmitted light, be full of detail in the high-lights, and not opaque, but semi-transparent. Time them the same as for contact negatives. Most photographers fail in producing a good solar negative by using their developer too strong, causing a coarse deposit on the high-lights. The proper strength of developer is from twenty to thirty grains to the ounce, with the addition of a little alcohol. Always fix the negatives for solar purposes in a weak solution of cyanide of potassium. It is preferable to hyposulphite of soda. Many do not observe proper care in sizing the figure on the plate, giving much trouble to the printer. Always make a standing figure small, so as to allow plenty of background; more than for a card or cabinet. For bust or vignette heads, make the heads never less than one and a quarter inches in length. A smaller size can be printed, but not always with such good results. As very few varnish negatives without showing lines and spots, it is best to leave solar negatives unvarnished.—W. L. SHOEMAKER.

A receipt for retouching solar negatives, I give you as follows: Make a varnish of

Alcohol,	16 ounces.
Gum Sandarac,	3 "
Camphor,	½ ounce.
Oil of Cinnamon,	a few drops.

Varnish the negative on both sides. Then grind by drawing the ball of the finger rapidly over the surface of the negative, from one end to the other, on the negative side, grinding the entire surface. Then grind the back crosswise in the same manner, being careful to move the finger in straight lines, as grinding in circles would spoil it. Then retouch the negative in the usual manner, and you have one that will print better than any contact

which a vertical frame, or screen, stands for the reception of the sensitized sheet upon which the image is to be printed. A holder for the negative, reversed vertically, is also provided in front of the sheet. The screen upon which the paper is fastened must be perpendicular to the axis of the lens and facing the middle or centre of the lens. Careful, fine retouching of the negative is not hurtful.

346. The next matter is to prepare the surface upon which the print is to be made. Albumenized and plain paper are used the most largely, but oftentimes canvas and wood are also employed. Whatever the substance may be, it must be sensitized and made ready by a method similar to that already given in the Lessons M and N. Canvas is to be used when the picture is to be painted in oil, and wood for engraving. The same guarded care as to dirt and light in the wrong place must be practised, and constant vigilance as to the time of exposure and after manipulations.

print of the same size. If the varnish should grind too coarse use less camphor, or more camphor if too fine.—H. D. WEBSTER.

To soften hard negatives for enlargement, first remove the iodide from the negative with hyposulphite of soda, wash, and then using a vessel with a large opening, place in it a small quantity of a solution of cyanide of potassium at four per cent., of ordinary water, which pour upon the negative at several intervals until it is brought to the desired tone. Now wash, dry, and varnish it. The cyanide is poured again into the stock-bottle, to be used until exhausted. For negatives that are already weak, the strength of the solution of cyanide may be reduced to from three to two per cent. By this process, whilst preserving all the delicacy of the modelling, one succeeds in obtaining transparencies, by which the negative gains considerably in harmony and softness. You may thus prepare for enlargement negatives of the desired transparency, and, if needs be, upon a plate bearing two negatives, choose the sharper one, which you can treat especially for enlargement, whilst you may leave the other for printing ordinary positives.—M. DARRICAU.

346. The brightest and most vigorous prints are obtained on the ordinary albumenized paper; and consequently, when the season is favorable and the sky unclouded, preference will be given to this paper for solar printing, when the prints are not to be retouched or colored. But, during the winter season, and the early spring and late autumn months, when the sun's power has diminished in vigor, and is frequently obscured by clouds, it is not advisable to attempt printing on albumen paper, because the exposure will be too long to be convenient, and may frequently have to be interrupted, during which time the paper may have changed its dimensions, and no longer lies flat. In such a case as this another mode of printing has to be pursued. The paper is sensitized the usual way, but on a strong silver solution for two or three minutes, that is, until it lies perfectly even on the solution, and the corners have settled down. The object in this is to get the paper sufficiently saturated with moisture; and the reason for using a strong silver solution is to coagulate the albumen, and not dissolve it off from the paper, which a weak solution would do.—PROF. J. TOWLER.

347. There are two methods of making solar prints. The first is known as the "ordinary" process, which consists in salting and sensitizing the sheet, putting it in the camera, and then washing, toning, fixing, and treating it generally as ordinary prints are treated, full details concerning which are given in Lessons M and N. Albumen paper or plain paper may be used in this way.

348. In some localities the photographer is blessed with very little sun-

347. A salting solution for cartoon paper may be made as follows:

Boiled Milk,	1 pint.
Glacial Acetic Acid,	10 drops.
Albumen from two large eggs.	
Bromide of Potassium,	80 grains.
Iodide of Potassium,	160 "

Mix thoroughly, and filter. The albumen should be well cut before adding it to the milk. Float or swab the paper with the salting for two minutes. The sensitizing solution is, viz.:

Water,	1 ounce.
Nitrate of Silver,	40 grains.

Swab this on evenly for two minutes. Develop with

Water,	8 ounces.
Pyrogallic Acid,	2 heaping teaspoonfuls.
Glacial Acetic Acid,	1 ounce.
Bromide of Potassium,	4 grains.

Fix with

Water,	10 ounces.
Hyposulphite of Soda,	4 "

GEORGE W. WALLACE.

To prepare canvas for solar printing, get a piece of prepared canvas, such as painters generally use; rub the little knots of paint down with fine emery and alcohol; then rub with alcohol until the paint is almost off. The rubbing must be done in circles, commencing in the centre of the canvas. Care must be taken not to rub too much, thereby showing the bare canvas. After rubbing, wash the canvas well with water. Mix kaolin with alcohol, to a paste; lay a good, even coating of the mixture on the canvas, and let it dry hard, so that when the stretcher is shaken the kaolin falls off in scales; now wash well with water, and salt with any of the usual salting solutions. After the picture is printed, toned, and fixed, give the canvas a coat of megilp. It is now ready for the painter. Some use gelatin for the last coating, but megilp takes the paint much better, and is in no danger of peeling off.—LEON VIDAL.

348. Printing by development in the solar camera is practised in all cases by some solar printers, but I do not think as good results are obtained in that way as by the other process. There are times, however, when the negative is so very intense that one can hardly spare a whole day, especially in winter, to make a print from it. In such cases we have to do the next best thing, and resort to printing by development. The operation is the same in principle to that of producing collodion pictures by the means of a developer, or, more properly, a reducer, and the same ingredients, pretty much, are to be used in its practice. I prefer to

shine of the quality needed for solar printing. He must then have resort to the "development" process, which consists in printing the image but partially, and then developing it to the full strength by after manipula-

salt my own paper, and use only a chloride, without the addition of either a bromide, iodide, or nitrate of uranium, as some use. For a salting solution use

Chloride of Sodium,	100 grains.
Hydrochloric Acid,	6 drops.
Distilled Water,	12 ounces.

Immerse two to three minutes and dry. Sensitize with

Nitrate of Silver,	1 ounce.
Citric Acid,	8 grains.
Distilled Water,	8 ounces.

Float about three minutes and hang up to dry. Blot off all the superfluous fluid from the corners and lower edge. The paper may be used before it is decidedly dry, if you wish, and should be exposed until a faint image appears. In direct sunlight I expose from three to four seconds; on a cloudy day, or in diffused light, about a minute must be given.

For the development provide a large porcelain dish, larger than your sheet of paper, and a sheet of clean glass, somewhat smaller than the print. Withdraw the print from the camera, being careful to keep it from the light, and lay it upon the glass face up. Fold down the paper at each side, beneath the glass, and place paper and glass together on the left side of your dish. Now take of the following developer—

Water,	6 ounces.
Pyrogallic Acid,	12 grains.
Citric Acid,	6 "

enough to cover the paper. Incline the dish downwards, to the right, and pour in the solution; then, raising the right side, cause the fluid to flow over the whole surface of the print, taking care to have it flow evenly. Lest markings and lines occur, let no stoppage take place. The development begins at once and proceeds as rapidly as in the case of a negative, and too much care cannot be given it. When the print appears sufficiently vigorous, stop the development, pour off the solution, and wash *thoroughly*. Fix until the whites are perfectly clear, which will sometimes take ten minutes and sometimes thirty. After fixing, the prints must be very thoroughly washed. They may be toned in the ordinary toning-bath. Tone in rather a weak solution, otherwise the strength of the prints will be reduced. Like in everything else, practice is needed to make one perfect.—Young Chloride.

This formula to prepare paper is among the oldest published:

Skimmed Milk,	½ gallon.
Acetic Acid, No. 8,	3 ounces.

Stir, and put it in a porcelain dish; bring to a boil, stirring all the time; strain out the curd through muslin (make Dutch cheese of this); take the serum, when cold, filter until clear. Now add

Iodide of Potassium,	16 grains.
Bromide of Potassium,	4 "

to each ounce of the clear serum. Float your plain paper on this until it lays smooth; see that no bubbles or spots rest on the paper; dry with moderate heat; prepare the paper in a

tions. Some parties prefer the results obtained in this way. As a rule, they are not so soft and delicate, and they should be made on stronger paper, because of the handling they must undergo, and because they must be passed through various solutions and washings. This method has a great advantage when the sunshine is scarce, on account of the very short exposure required by it. When the prints are to be worked up by the brush or pencil, they answer quite as well as those made by the other method.

room free from dust or actinic light, and if kept in a cool, dry atmosphere, it will keep in good working order a long time. To use, float two minutes on a solution of

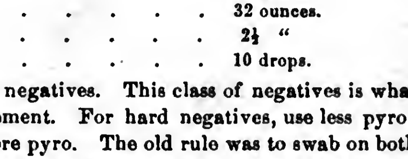
Silver,	640 grains.
Water,	16 ounces.
Acetic Acid,	2 "

Draw the sheet off the silver solution over a glass rod. Having previously focussed your picture, place your paper, while damp, in position, and let on the light; print according to the density of the negative. A very hard negative requires printing until the detail is well out, and developed with a *very weak* developer; on the contrary, a *very thin negative* need not show any detail, and must have a stronger developer, which is prepared as follows:

Pyrogallic Acid,	90 grains.
Water	32 ounces.
Acetic Acid,	2½ "
Citric Acid (saturated solution),	10 drops.

This is for medium, or good for printing contact negatives. This class of negatives is what is required for making enlargements by development. For hard negatives, use less pyro; for weak, such as regular solar negatives, use more pyro. The old rule was to swab on both the iodizers and the silver; but in that way you are pretty sure to get streaks and stains in about half or more of the prints you try. In developing, lay the paper, face up, on a clean board, on which a clean piece of white bibulous paper is laid. Have the developer in a wide-mouth bottle. Commence at one end, and apply enough with one sweep of the hand to completely cover the print; now watch it grow. If stains or fog occur, either you have overtimed, or allowed actinic light to get at the print, especially so if the picture pops out quick and then blackens all over. If it comes up slowly and stains from this cause, add more citric acid. As soon as developed, plunge it into clean water, and from that to the hypo, for clearing, of usual strength; then wash as usual. Thick paper needs longer and stronger cleaning than thin. If the print comes up too flat in developing, add a little acid silver solution to the pyro.—A. HESLER.

FIG. 95.



My method of enlarging common card negatives is as follows: I made a box seven feet long, fitting my 10 x 12 shield and ground-glass the same as on my camera. By placing two movable slides inside of the box, marked A and B, fastened to rods D, D, slide A is fitted so as to hold quarter or half size plates. By a movable frame fastened on slide A, slide B is to hold a quarter- or half-size lens. The slide B is also fastened to rod D, running under the box in a groove so as to exclude all light; C is to hold

349. Up to within a twain of years, the usual results produced by means of the solar camera would not bear comparison with those from contact negatives, and to render them at all tolerable they must be retouched or worked in color in some way. This was due to the fact that every defect in the tiny negative must be greatly enlarged, and of course made so much more obtrusive in the print. This gave rise to several methods of preparing the negatives so that these blemishes would be almost entirely overcome. A great deal of money has been paid to obtain the "secret"

ground-glass and shield. By placing the negative in slide A, and moving the rods D, D, you can get any size transparency, by which you can make fine negatives of any size, or as many negatives from the transparency as you wish. This is a cheap way of making enlargements, and will well serve those who cannot afford a solar camera for such small work.—NEAL P. HARRINGTON.

349. My solutions for reducing the negative are, viz.:

No. 1.—Bichloride of Mercury,	. . . .	3 grains.
Rain Water,	. . . .	1 ounce.
No. 2—Iodide of Potassium,	. . . .	3 grains.
Rain Water,	. . . .	1 ounce.

To reduce, flow the negative with No. 1 and wash under the tap. Flow the negative with No. 2 and wash under the tap. Fix in cyanide and wash under the tap. If not sufficiently reduced, repeat above until satisfactory.—F. C. PHILLIPS.

For the retouching preparation use

French Sheet Gelatin,	. . . .	1 ounce.
Rain Water,	. . . .	18 ounces.
Acetic Acid,	. . . .	½ ounce.

Filter through a fine sponge in a warm place. While the negative is wet, flow with the retouching preparation, only in sufficient quantity to dry with a gloss, holding level over lamp or stove until thoroughly dried. Grind with sifted pumice-stone or tripoli all parts where retouching is needed, If too much tooth, rub with Canton flannel and retouch (stipple) as finely as possible. Touch in the lights in the drapery where needed with a soft lead-pencil. Touch the laces with Florence white. Breathe heavily over the retouching to fasten it. If the negative is warped, find a glass to match with it perfectly. Warm the cover glass and pour on a sufficient quantity of balsam of fir (hardened by heat) to flow between and around the edges, leaving a bead of the balsam of fir all around the edges of the negative. Rub the negative surface, excepting the retouched portion, with a small tuft of cotton and a drop of sweet oil, removing all surplus oil with clean cotton. After the glasses are together and the edges are completely covered with balsam, bind the edges with heavy sticking-paper, rubbing down closely over the edges, to exclude the air and prevent the balsam from coming out while printing. The glass must fit closely together to prevent coming apart while under the heat of condenser. Never use a negative smaller than cabinet size for a full sheet print. Use a half-size portrait tube for the objective.—L. W. B.

Instead of the usual varnish, flow with a solution of gelatin, one part to six of water (or nearly that proportion), holding the plate level over a strong but diffused heat until the

of these processes, and patents have been obtained for modifications of them, but it is believed that what follows is good and free to all. If the negative is too dense for solar printing, it may be reduced, then retouched, and finally prepared for the camera. When so prepared and printed, the results may be quite comparable with contact or direct negative prints.

gelatin sets perfectly smooth and glossy, which will soon be acquired by practice. Grind in the usual way with pumice to make a tooth for retouching, which is done in the usual style, being careful to have as fine as possible. After the retouching is done breathe on the film, which blends it *into* the gelatin, so that it may be rubbed over with oil, glycerin, or any other substance, giving a transparent film free from grain or line. A little salicylic or No. 8 acetic acid, or, better, ten drops of a saturated solution of alum, will preserve the gelatin from decomposition, and keep it from dissolving again.—C. Tomlinson.

To one quart of rain water add

Alum,	1½ ounces.
Bichloride of Mercury,	1½ "
Loaf Sugar,	1½ "
Acetic Acid,	½ "

To reduce the intensity of the negative, flow over (after clearing and washing) with this solution. Then wash and flow with strong cyanide of potassium, wash and repeat as often as necessary, to reduce to proper intensity. Then flow with gelatin, and dry, and retouch finely. Now take another glass, perfectly clear, and flow over with pure balsam of fir; heat both negative and other glass, and then place them together; use two pairs of wooden pincers to fasten them. See that no air remains between the glasses, and finish by pasting gum paper around the edges. By following this process no one need have any trouble to get fine solar negatives of any intensity, as you can reduce your negative as far as you wish, and stop.—N. P. Harrington.

I will try and give you something that is practical in the way of a solar-printing process that has no patent, and is equal to the best. It takes less preparation, and the same negative is just as good for contact-printing afterwards as ever. In this process any contact negative may be used. Made in the ordinary way and nicely retouched, it is all ready for use with the following directions: Take the negative and with a piece of chamois skin carefully clean off all finger-marks, being careful not to disturb the retouching; now take another glass of the same size, free from scratches and blisters, clean it thoroughly; next get a piece of India-rubber tubing about one-eighth of an inch in thickness, lay the rubber tube on the negative all around the edges, except a small space at one end, leaving an opening between the two ends of about one-half inch; now lay the other glass on to the rubber and bind the two together, this will leave a space about one-eighth inch between; now at the end where you have left the open space, pour in pure glycerin until it is filled up; now place your negative in the proper position in the solar, and it is ready for printing, and will make a soft and delicate print in much less time than it would take otherwise; the glycerin coming in contact with the retouching, obliterates all marks of the pencil and makes it more transparent, and the result is a fine, soft photograph, full of detail and roundness, often surpassing the contact-print. After the negative has done its work, separate the glasses and wipe off the glycerin, and your negatives are all ready to make contact-cards again. In placing the

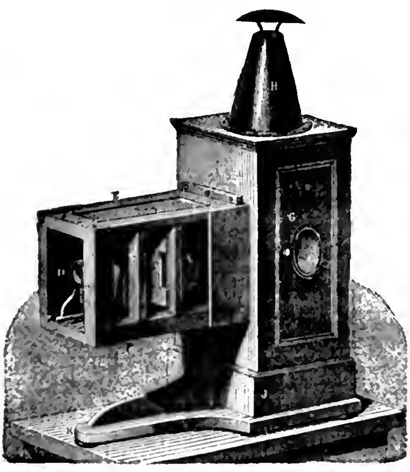
350. So far it would seem that the only method of making enlargements is by means of solar or sunlight, but such is not the case. The ordinary magic lantern may be made to serve in place of the sun and provide artificial light of sufficient intensity to answer every purpose. And again, light through the camera may be dispensed with and a tracing apparatus be made to do when necessity or convenience compels it. The *Philadelphia Photographer* must now be called upon to give up some of its information to tell us how.

negative in the solar, put it in the usual way, the retouched surface facing the paper, and print through the glycerin, unless you wish to make a reversed picture. The glass does not seem to become near as hot in printing as by the old process, thereby lessening the danger of breakages.—E. P. Libby.

When printing from a coarse, hard negative, one that is badly varnished perhaps, and a good clean and soft print is desirable, or a print from any solar negative is wanted that will need no spotting, proceed as follows: Print about *half done*, then lay over the unfinished print a piece of ground-glass same size of the print, and always with the ground side towards the condenser, and continue printing. This will have a softening effect, without affecting the sharpness; ordinary blemishes disappear as if by magic, and a good print is made possible by this means from negatives that would ordinarily yield bad results. Try it. —C. A. Zimmerman.

350. Drawings of the needful apparatus for solar printing by artificial light are as follows: A box, G, surmounted by a chimney, H, or, in other words, the box of a magic lantern, includes the blow-pipe and other apparatus necessary for producing the light. A triple system of condensers, say five inches in diameter, is placed laterally upon the box at A. To this the parts of a solar camera described are to be attached in the manner shown in the cut, so that the negative is at O, and the amplifying objective is at D. The blow-pipe should have its luminous point exactly in the focus of the condensing lenses. For this purpose the objective, D, is used as a guide, the luminous cone passing freely through it. By advancing the blow-pipe towards the interior lens, or by drawing it back, the brilliancy of the field may be considerably varied, and it is therefore necessary to pay particular attention to this point. As the luminous point of the blow-pipe is variable in the direction of the height, it is by means of the rack and pinion attached that the luminous point may always be brought on the axis of the apparatus. This apparatus is arranged for the oxyhydrogen light, but an oil sciopticon may be adapted to the same kind of work, acting more slowly, of course.

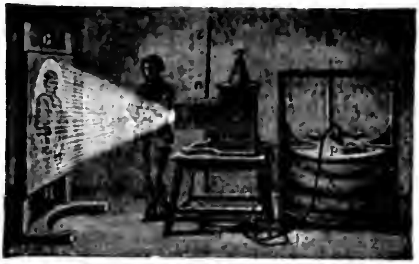
Fig. 96.



351. A great many photographers cannot afford a solar camera, and an apparatus that would enable them to have some of its advantages will doubtless be of service to them. All photographers, after the careful study of Gihon's *Photographic Colorists' Guide*, can make good use of their spare time in crayoning, and inking or coloring enlargements from their

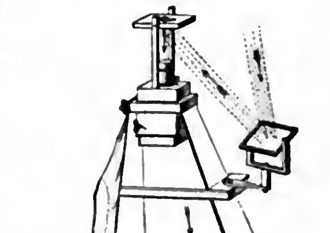
The next figure represents the general arrangement of the apparatus in use, including the gas-bags for the gases used, and all the connections necessary. Such an enlarging apparatus as this may also be used with artificial light for making, with wet collodion, large negatives on glass from a small positive on glass, which requires an exposure of but a few seconds.—Dr. D. von Monckhoven.

Fig. 97.



851. My invention is for tracing or sketching for crayon or other portraits. It can be used by any one, and for enlarging any object that can be attached to the top, which is to contain the picture, face down. It can be made for any size, from 8 x 10 to life-size. The lens, the movable front for focussing, clamps for holding the movable top, which is adjusted from inside, and governs the size of the object, and the reflector, to throw strong sunlight on the object, will all be seen in the diagram; also, the table or stand upon which the paper, or material upon which to draw the image as it is reflected down, is placed. This is a very useful instrument for any gallery, as any card can be enlarged to a perfect 8 x 10, or larger, to show the customer how he would appear in a large portrait, which might induce him to have one made. The one I have is intended for a ten-inch head, or from that down to 8 x 10. It is two feet square at the base, four feet high, fifteen inches wide at the centre, with a twelve-inch arm to the reflector. The reflector has three movements, or six, counting the backward movements. The movable box has only two movements, up and down, for governing the size of the reflection. The box is nine inches square, one inside of the other, fastened with a thumb-screw inside of the front curtain. The movable top is raised and lowered from the inside, and fastened by a clamp with a thumb-screw in front. The thumb-screw is ten inches long, to reach clear across the front. The strip across the centre, holding the reflector. is eighteen inches long. The box or frame work is covered with soft flannel, and lined with thick yellow paper, so no light gets in save the reflected light. It will be observed that the image is very strong, and has the appearance of a finished picture. The rays falling in at the top make it a very pleasant light to work in, just right for comfort, something like twilight. It takes one to trace by measure, as all portraits do on canvas or cardboard, from two to four hours. An artist

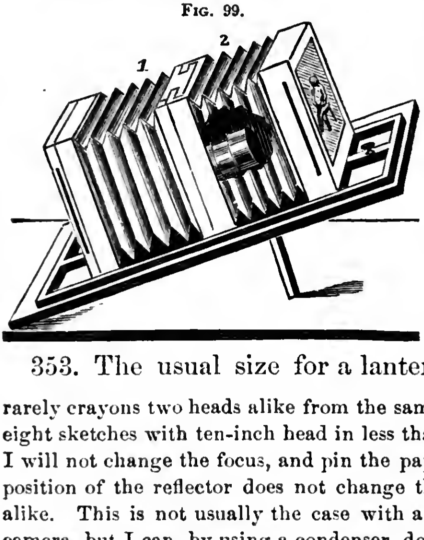
Fig. 98.



negatives. The first step is to procure the enlarged sketches of the picture you propose to make. This can be done by means of the apparatus which is described below by the inventor, if you have not a solar camera.

352. The popularity which the magic lantern is gaining makes it an advantage to know how to produce transparencies for it, for enlargement upon the screen. True, the best and most interesting subjects come from abroad, but since the modern lecturer scarcely dare appear upon the stage without a lantern to assist him, he must often call upon the local photographer to make special slides for him. The photographer, then, should have a few plain directions how to proceed. If the "wet" process is used, an arrangement similar to that shown in the drawing is employed, two cameras of, say, 8x10 size being placed front to front upon an inclined platform in a room with a southern exposure. The negative is fastened in the upper end, and the holder containing the sensitized plate is placed at the back of the other camera. Careful focussing, clean plates, ripe collodion, exact exposure, and thoughtful development are all needed.

Fig. 99.



353. The usual size for a lantern slide is $3\frac{1}{4}$x$4\frac{1}{4}$ inches. Of course,

rarely crayons two heads alike from the same picture, and do his best. I can with this make eight sketches with ten-inch head in less than an hour, and have them alike every time, for I will not change the focus, and pin the paper each time at the same place. Changing the position of the reflector does not change the reflection, as it leaves the picture every time alike. This is not usually the case with a solar printer. I am a great friend to the solar camera, but I can, by using a condenser, do the same work by this.—S. L. Platt.

353. A good bromo-iodized collodion tolerably ripe, with a bath in good working condition for negatives, will give good results. We give a full exposure, and develop rapidly with an iron solution containing a large proportion of acetic acid—about fifteen grains of the iron salt and thirty minims of acetic acid to the ounce of water. This gives a transparency in which the deposit is, by transmitted light, of a warm, purple-brown tone. If a blacker tone be required, it is easily obtained by using the gelatino-iron developer, though a black color is not the best. Where a very black tone, both by reflected and transmitted light, is required, toning by means of bichloride of mercury, followed by a dilute solution of ammonia, or of hyposulphite of soda, gives excellent effects. For the magic lantern, transparencies are best toned by a saturated solution of bichloride of mercury, followed by a weak solution of hydrosulphate of ammonia, care being taken to well wet the plate before applying the mercury solution, and wash well between each operation. The color will be determined by the

the image should come within this, for a margin must be allowed for a mat. Focus in the centre of the plate, and use the smallest diaphragm. The positives may or may not be toned; if they are, gold may be used, or, better, sulphuret of potassium. After the manipulations are over and the transparency varnished, a mat and a cover-glass are placed over it,

strength of the hydrosulphate of ammonia solution. Experience alone will determine the best proportion, but about six drops to the ounce of water will be found an average proportion. To test their suitability for the lantern lay them on white paper; the lights should show only white paper, but the shadows should be perfectly black. The following method of toning transparencies, whether produced on wet collodion or dry plates, gives a rich, warm, brown-black, very nearly resembling the well-known color of the albumen transparencies of Messrs. Ferrier and Soulier. It is necessary to observe that a thin, slightly over-exposed transparency is best suited for the treatment. After fixing and washing take a little of the pyrogallic developer, a few drops of the silver solution, and a few drops of glacial acetic acid; pour it on and off the plate until the picture is nearly as vigorous as you require it to be when finished. Wash well, and apply a saturated solution of bichloride of mercury until the image is quite white. Wash again thoroughly. Next take a thirty-grain solution of ammonio-nitrate of silver, and pour it on the plate—it immediately changes to a greenish yellow tint, and gradually darkens; add a drop or two of ammonia, it will hasten the change of color, and very soon the picture will stand out bright and clear, of a brown sepia color. If the transparency be varnished, a fine textureless varnish should be used, and great care used to avoid dust. In many cases a greater degree of richness and transparency in the shadows is obtained by varnishing; but where the photograph is perfect, it is better unvarnished, the picture being protected by a thin glass instead. If ground-glass be used at the back, it should be very fine; but the benzole varnish known as "crystal varnish," with two or three grains of white wax to each ounce, forms an excellent substitute for ground-glass, drying semi-opaque with a fine texture. A thin solution of starch applied, but not too hot, also forms an excellent substitute for ground-glass. For the magic lantern, a semi-opaque backing is not, of course, required.—J. TRAILL TAYLOR.

I have fallen back on a modification of the old wet process, borrowing from different workers the formulæ employed. The bath, which should be sunned and filtered before adding the acids, is composed of

Silver Nitrate,	½ ounce.
Water,	10 ounces.
Nitric Acid,	3 drops.
Acetic Acid,	12 "

The plates are coated with a ripe collodion, being first rubbed with French chalk, and immersed for at least five minutes. I develop in a glass-bottomed dish with the following:

Pyrogallic Acid,	30 grains.
Citric Acid,	1 drachm.
Acetic Acid,	2 drachms.
Alcohol,	2 "
Nitric Acid,	7 drops.
Water,	10 ounces,

and fix with hyposulphite of soda. The developer acts slowly, so that density and detail are

and the whole sealed together by means of a border or binding of black needle-paper.

354. There are several other methods besides the "wet" of producing these beautiful pictures. The "wet" is easiest because most like the ordinary work of the photographer, but, by means of it, a film is given

well under control; and, as lantern slides often require strong contrasts, this is an advantage. Another advantage of this developer is, that it yields a pleasing tone at once without requiring the after application of chloride of gold, etc., which is necessary when the pictures are developed with iron. The transparencies are best taken in the camera, and, with ordinary care and judgment, this process will reward the operator with very good specimens.—REV. B. HOLLAND.

I always make the sulphuret solution a deep orange color and filter before using, as the same strength does not answer for every sample of collodion. I test by *pouring* on a plate, not wishing it so strong that it will in a second or so turn black, but it should take several seconds, sometimes longer, before the stain is deep enough. It is deep enough when bluish, then pour off the solution (do not use the same again), carry the plate into the strong light; looking through, watch its action. When it has passed the gray-blue it gradually deepens; when just purple douse it under the tap. If the action is carried any further, it becomes a deep sepia, which will flatten the picture; when a dark-blue, or what will appear on the screen solid black, is wanted, stop the toning at the gray-blue, and wash. When the positives are overtimed, it is impossible to get any other than a sepia tone. When under-exposed, they are hard. New collodion not too thick makes the best positives, as they have not that solidity that ripe collodion gives. Very old collodion has some of the same properties of new, but the action of time is very slow, yet good results can be obtained. The action of sulphuret of potassium as a toning agent is peculiar, as it makes translucent what otherwise would remain smoky or a mass of black shadow. For reproducing negatives, the toning is omitted. Place the negative in position, varnish side out; give time until full detail is obtained with a quick development; fix with cyanide of potassium. While wet place the positive in the place of the negative, face outward, and expose less than *one half* of the previous exposure by ordinary development. By this means a negative can be reproduced nearly equal to the original.—W. L. SHOEMAKER.

354. Transparencies upon collodion cannot match those on albumen in any way. The film is so fine that even in the deepest shadows there is a transparency, and, as it were, detail, which would have been blocked out or lost in a collodion film, not to speak of the rich tone which can be given to an albumen positive with very little pains. Although not so rapid as collodion, they will give transparencies superior to the other. I will now treat the subject fully: 1. The dark-room; 2. Preparation of albumen; 3. Cleaning and polishing the plate; 4. Coating the plates with albumen and drying; 5. Sensitizing; 6. Exposure and developing; 7. Toning.

The first subject requires the most care. The dark-room must be very small, the ceiling and the walls painted in oil, the floor laid with marble or slate slabs, a large sheet of plate-glass fixed to serve as a table, a kind of a cupboard with levelled glass shelves, and as few chemicals as possible. This is what the dark-room must contain in order to prepare albumenized plates with any degree of certainty. Dust is the greatest enemy of this admirable process, and it is the first to be vanquished, that is why I advise a small room. The walls, ceiling, and floor are so arranged that they can be washed now and then to take off the

which is not nearly so delicate and structureless as that obtained by the albumen or emulsion process. Hints as to both of these are given in the notes—as much as will enable any tasteful manipulator to secure

dust. The drying cupboard is made of varnished zinc, as in Fig. 100. *a*, plate-glass shelves the same width as the cupboard, but an inch and a half shorter; the first shelf touches the zinc on the right-hand side; the second shelf touches the zinc cupboard on the left-hand side, and so on, alternately, to the top of the cupboard. On the right-hand side of the bottom of the cupboard is a hole, B, over which is soldered a piece of fine wire-gauze, covered with a piece of fine linen. This hole is an inlet for air, and the fine linen acts as a filter to stop dust and dirt from entering with the air. It would be well even to dip the linen into a little glycerin, and change it now and then. On the left-hand side of the top is another hole which forms outlet C; this is covered by a piece of sheet-iron piping, in the interior of which is placed a Bunsen burner, D. The prepared plates having been laid upon the glass shelves, the doors, E E are closed. The Bunsen burner lighted, a draught is established in the chimney, and fresh air is drawn through hole, B, which, following the arrows, Fig. 101, passes over the surface of all the plates and dries them very quickly; if the air be very damp, it can be made to pass through chloride of calcium. In fact, it can now be seen that to succeed with this process great cleanliness is required, and above all, great care not to open doors too rapidly, or go in and out of the dark-room too frequently, so as to raise the dust. I dwell very long upon this subject, being certain that this is one of the greatest stumbling-blocks in the process.

Fig. 100.

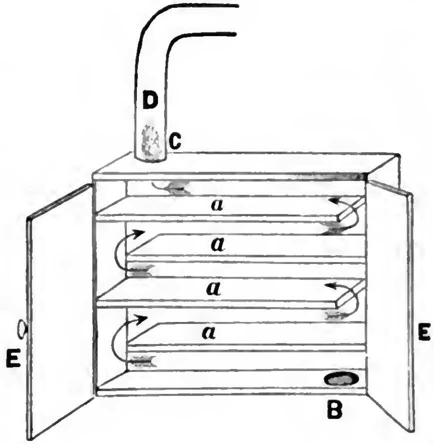
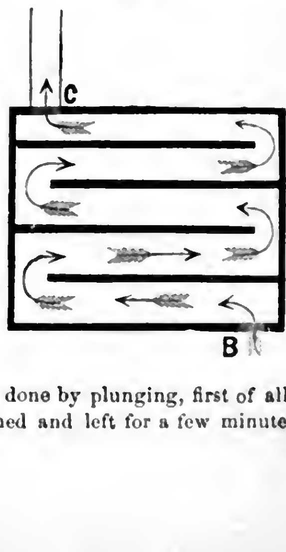


Fig. 101.



In preparing the albumen, take seventeen newly-laid eggs (eggs a week old are the best), break them, and carefully separate the yolks from the whites; take out the germs (treadles). Weigh out five grammes of iodide of potassium, one-quarter gramme iodine, mix therewith five hunded c. c. of albumen, then pour into a large basin and whisk into a froth; this is allowed to remain twenty-four hours in a cool place to settle down; the product is then filtered through a piece of clean linen, and is then ready for use.

Cleaning of the glass: It can be easily understood that the first condition to obtain a pure and perfect image is to cleanse the surface of the glass from all impurities. This is done by plunging, first of all, the glass in a strong solution of potash; it is then well washed and left for a few minutes

lovely results. A great many persons fail with lantern slides who make excellent negatives. The greatest judgment is required in the matter of exposure and development. It is impossible to save an over-timed transparency, and an intense one is of no use in the lantern. As to the emulsion method, refer also to Lesson U.

in a tray containing water slightly acidulated with nitric acid; it is then well rinsed and wiped dry with linen towels. Take fine whiting and with water make a thick paste, and wipe or spread it all over the glass and allow it to dry, then rub it all off with a piece of fine linen. A few grains of talc (I mean as much as would lie upon a pin's head) are now put upon the glass, and rubbed over it in every direction with a piece of wash-leather. A badger-brush is now drawn over the surface, and the glass is ready for coating

Coating the plate is considered by all as the most difficult operation. This must be done in a room set apart for the express purpose and free from dust. The best manner of operating is to take up by a tube the exact quantity of albumen required for each plate; breathe upon the glass, and let the albumen run out of the tube; take a clean glass rod and equalize it all over the surface, and then put it into the cupboard, upon the levelled glass shelves, to dry in the manner as previously described. The plates thus prepared can be kept for years.

Sensitizing is done in the same manner as with the collodion process. The bath is prepared as follows:

Distilled Water, ...	100 ounces.
Nitrate of Silver, ...	10 "
Glacial Acetic Acid, ...	10 "

After the plate has remained about a minute, it is taken out of the bath and plunged into a tray containing distilled water; it is then thoroughly washed in ordinary water and left to dry. After a time the silver-bath becomes tinted through the organic matter dissolved out of the plates. This color can be taken away by the addition to the bath of some chloride of silver or silicate of alumina (kaolin). This coloration does not exercise any bad effect, according to the opinion of several manipulators.

Exposure and developing: If the plates are intended for stereoscopic transparencies, lantern slides, etc., the negative is put into a printing-frame, and the prepared glass upon it. It is then exposed to a diffused light for a few seconds, and then taken into the dark-room to be developed; naturally, the camera can be employed for the same purpose. The development of these plates is long and tedious. A solution of gallic acid is made warm and the plate plunged into it:

Distilled Water, ...	500 c. c.
Gallic Acid, ...	8 grammes.
Acetate of Lime, ...	4 "

The plate is left in this solution until the liquid becomes cold, a few drops of a solution of silver nitrate are added, and the image makes its appearance. More nitrate will intensify rapidly.

Toning glass transparencies is necessary to give them the pleasant appearance they bear. To have a beautiful purple color, they are toned in a chloride of gold bath. To procure a very agreeable sepia color, they are plunged into a weak solution of bichloride of mercury, and then, after washing, into a chloride of gold bath. Fix in hypo, either before or after toning.—PROF. E. STEBBING.

There is no doubt but what the emulsion method will, in time, become the favorite one for making slides. It can be used "dry" when the positives are to be of the size of the negative, or "wet" when a change in size must be made, requiring the use of the camera. The best foreign slides are made by a kindred process, and they are superior to all.

It is now between seven and eight years since I exhibited before the South London Photographic Society some plates—both negatives and transparencies—I had at that time prepared, and which, I believe, were the first publicly shown produced by the gelatin process. I still have some of these specimens by me. They are quite as fresh and as brilliant as when first made, and the clear parts are as clear as the glass itself. This, I think, proves there is little amiss with the process. I will now endeavor to point out the causes of failure. One of these arises in the preparation of the plates, and to those who are interested in this branch of work my advice is, Do not aim at making very rapid plates. Great rapidity in transparency work leads up to failure; the slower the plate the more certain and more brilliant will be the result. When I say the fraction of a second is quite exposure enough with even a slow plate, I fancy I hear some one say, "Well, the plates cannot be very slow." Well, perhaps not, if compared with the old collodion dry plate; but we are not now dealing with collodion but with gelatin, therefore the conditions are all altered. I believe it is from not fully appreciating the necessity for rapid exposures that so many fail in transparency work. The exposure has been too long—the result, thin image and fog; and when this occurs by no, possibility can a presentable transparency be obtained. The most expeditious and certain way to make transparencies is to make them by contact. If necessary to enlarge or reduce the image, then, of course, it must be done in the camera. In most negatives there are some portions that may be made use of for lantern sides. In this case all you have to do is to cut a mask in black paper the size you require for your lantern slide, put the negative into a printing-frame, place the mask in position, then the sensitive plate, close the frame, cover the front with a piece of cardboard, take it into the light, uncover and cover again as quickly as possible, giving only the fraction of a second for the exposure. I am now supposing we are working by daylight. If by gas or a paraffine lamp, hold the frame about six or eight inches from the flame, and give from one to two seconds, according to the density of the negative used. When exposed, the development may be the same as in my instructions for negatives, with either the alkaline pyro or ferrous oxalate. After development well wash, and then flood the plate with acid pyro and silver (see also instructions for mixing). The pyro and silver is only used to give a bite to the gold in toning. Again well wash after the pyro and silver; then flood the plate with a fifteen-grain solution of chloride of gold in water—gold twelve drops, water one ounce. Keep this moving over the plate until the required tone is obtained, again wash and pour over the plate a very weak solution of cyanide of potassium; wash and dry. If the cyanide be not used, the plates will after a time present a beautiful pinkish tint in the transparent parts, which in some subjects has a very pretty effect. After the first fixing in hypo all the rest of the operations may—in fact, should—be carried on in the light, as in that case you can see exactly what you are about. It is always better when preparing lantern slides to cut them to the size before coating. This prevents all risks of their being spoiled by cutting after the transparency is finished.—R. Kennet.

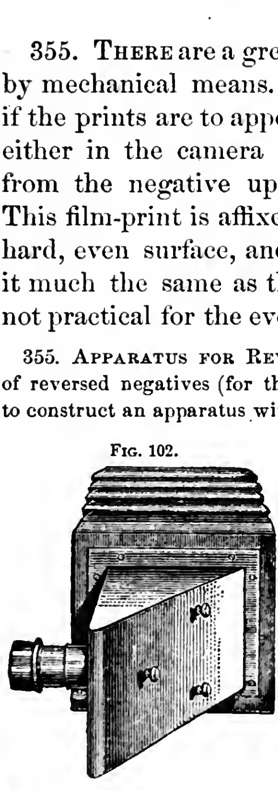
LESSON X.

PHOTOTYPES, PLATINOTYPES, AND COLLODION TRANSFERS.

355. THERE are a great many methods of printing photographic pictures by mechanical means. A negative is made in about the usual way, and if the prints are to appear right and left as in nature, it must be reversed, either in the camera or transferred after it is made. A print is made from the negative upon a gelatin film sensitized with a bichromate. This film-print is affixed to lithographic stone, metal, glass, or some other hard, even surface, and then the impressions, or prints, are pulled from it much the same as the common lithograph is printed. The process is not practical for the every-day work of the photographer whose patronage

355. APPARATUS FOR REVERSING THE NEGATIVE.—The increasing employment of late of reversed negatives (for the carbon, artotype, asphaltum, and other processes) induced us to construct an apparatus with which not the object itself, but its reflected image, is photographed directly as reversed. The apparatus consists of a rectangular prismatic box of mahogany, on the plane of the hypothenuse of which a mirror or prism is placed in such a way as to allow of easy and exact regulation of its position from the outside through the three screws appearing in the illustration. One of the planes of the casette is closed with a rough board, to protect the mirror or prism. In order to fasten the apparatus to the camera, it is unscrewed from this closing board, and screwed with the same plane on to the objective side of the camera. The other plane is closed with a movable board, which serves to hold the objective. The position of the mirror or prism is correct as soon as the image, reflected through the objective, appears in a perfectly circular form upon the dull disk, and this position is easily regulated by the screws. The apparatus is furnished with either a rectangular, complete reflecting crown-glass prism of superior finish or with a mirror. The latter consists of a perfectly plain ground-glass plate, the front side of which is well silvered, and which is of such reflecting power that only a very slight loss of light occurs, which does not occasion any disturbance even in portrait photographing. Mirror and prism reflect perfectly correct, and are of equal merit in this respect, but the loss of light is even yet slighter with the prism than with the mirror.—ROMAIN TALBOT.

FIG. 102.



The following method of obtaining reversed negatives was described by Captain O.

demands only small lots of prints from any one negative; but for trade purposes it is well adapted, and is largely practised, especially in Europe. There are many modifications sailing under various claims for originality, and patented, but it is believed that the public is entitled to what is given below, the basis of it having been published by one of the earliest workers in this direction—Prof. Husnik, in 1875. The only elaborate work upon the subject is published only in the French language by Mons.

Volkmer, as in use at the Imperial Military Geographical Institute, Vienna. The negative is wetted and coated with a warm, filtered solution of gelatin, one to thirty, poured in and drained off just like collodion, and then dried in a horizontal position. It is next coated with plain collodion, and when this is set it is soaked for half an hour in a dish of water, and then laid down flat on a table. A sheet of thick, well-sized paper having been cut to the size of the picture and well wetted is laid down on the collodion, a piece of blotting-paper is placed above it and lightly rolled down with a roller. The blotting-paper is then removed, and the edges of the collodion film having been cut to within half an inch of the paper all round are turned over the paper, and then the sheet of paper with the film attached to it is lifted off the plate. A sheet of paper is then wetted and laid down flat on a glass plate, and covered with a solution of gum-arabic, one to three. The collodion film is then laid on the gummed surface, with the paper above it; a sheet of blotting-paper is put over it and rolled down. After the removal of the blotting-paper the turned-over edges of the collodion film are laid back on the gummed paper, and the first sheet of paper is removed. Finally, a glass plate is levelled and covered with as much water as it will carry. The collodion film attached to the gummed paper is laid face downwards upon this, and the water drained off. The plate is then laid on the table again, covered with blotting-paper, and rolled. The blotting-paper is then removed, and the gummed paper stripped off. The plate is washed to remove all traces of the gum, and dried. The method is rather complicated, but seems an efficient way of performing a rather troublesome operation.—MAJOR T. WATERHOUSE.

To produce reversed negatives direct in the camera use a piece of ground-glass, or a piece of plain glass covered with mat varnish in the dark-slide as a focussing-screen—the dull surface farthest from the lens. The same end may be attained by pushing the dark slides a little in just before exposure, or by turning the lens a trifle back after focussing in the usual way. Now use a gelatin plate with the glass surface nearest the lens, simply protecting the film from injury by the spring of the dark-slide. The development will, of course, be according to the directions sent out by the makers of the plate used. This method will be found to produce a result equal to, if not better than, any of the systems now in use.—ARTHUR F. FENTON.

Having by the following method reversed some hundreds of negatives up to twenty-four by eighteen without a single failure, it can be confidently recommended as an expedient where a reversed negative is absolutely necessary. It applies only to collodion negatives which have not been varnished. After the negative has been washed and dried, coat with a thin film of India-rubber and allow to dry. Coat over the India-rubber with plain collodion and dry on a levelling-stand. Cut quite through the film at the edges with a sharp knife. Place in a tray of cold water, and in a few minutes the corners and edges will be seen to lift. Now, by taking hold of two corners, the slightest touch will remove the

Leon Vidal, the distinguished photo-experimentalist and author, of Paris, from whose excellent work, *Traite Pratique de Phototype*, much of the information given in the notes is gathered. A workable process is thus provided for all who deem it to their advantage to test its value. This is the only photo-mechanical process it is believed that it will be necessary to treat of herein. Proceed as below.

356. Basis.—As a basis, employ a polished glass plate, three lines in thickness, or may be thicker. These plates are polished mat on one side by rubbing them with finely levigated emery powder; the powder is moistened with a little water, and applied to the glass surface, the emery being uniformly moistened by rubbing with the finger. This is very necessary, for should any dry emery come in contact with the glass, deep scratches are at once produced. Another glass plate is placed upon the one covered with moist emery, and the former is rubbed by a circular movement, and with very little pressure. In a few moments you perceive that the noise from the breaking up of the large particles ceases, and then more pressure, and freer and quicker manipulation may ensue. For about ten minutes the task should be continued, the grains of emery becoming smaller as the work proceeds, and the mat surface of a finer character. If, after the plate has been washed, it turns out that the glass surface has not been evenly rubbed, or that, by reason of the inequality of the plate, certain portions have not been touched, the grinding must be proceeded with, a fresh supply of emery being obtained. The action must be con-

double film from the glass. The tray should be large, deep, and quite full of water; then in the operation of stripping the film will be turned over. Remove the glass from the water, leaving the film floating topsy-turvy; wash the strips off the edges, dip into clean, warm water, and flood with a *thin*, warm solution of gelatin. Rest one end of the glass on the edge of the tray, and the other on some support to keep it level. Now lift the film by the two nearest corners, and gently draw it out of the water on to the glass. It will easily slip over the gelatin without bubbles. Tilt the glass, keeping hold of the corners to prevent the film slipping off, and gradually raise it to let the surplus gelatin drain off. Any stray gelatin which has run over the surface can be removed by now washing, or after it has dried. The India-rubber solution can be made by dissolving thin sheet India-rubber (black) —such as tobacco pouches are sometimes made of—in benzine or benzoline. If the latter, see that it be free from paraffine, which would prevent the India-rubber from drying. The use of the coating of India-rubber is to prevent the coating of plain collodion from dissolving that containing the negative. A very thin coating therefore suffices. For large negatives, a second coating of India-rubber and collodion is advisable. Negatives so reversed have one single fault—the film is easily scratched. Great care is therefore necessary with these for our work.—George Smith.

tinued in order to reduce the size of the grains as much as possible. In this way two mat plates are produced at one and the same time. If it is a question of employing plates a second time, these, in order to be freed from gelatin, are put into a lead or zinc vessel containing an alkali solution formed of slaked lime or soda. This alkaline liquid may be preserved in good condition for more than two months, and may, by the addition of a further quantity of lime, be invigorated when necessary. In a bath of this kind the hard gelatin film becomes softened in a period of twelve hours, and the glass may then be cleaned with sawdust, or some such material, and washed. The plates are then ground with emery powder in the manner just described, in order to free the pores of the glass from any gelatin remaining in them. Finally, the plates are rubbed with a rag, and rinsed in several waters, and then dried.

357. First Preparation of the Plates.—Take twenty-five parts of white of egg, forty-five parts of distilled water, and eight parts of solution of soda water-glass, such as can be obtained in commerce. The white of egg must be perfectly free from the yolk. The three constituents are mixed together, beaten to a froth, and then allowed to stand. Next day, or at any rate after an interval of six or eight hours, the clear portion is decanted off and filtered through a clean cloth. This will render subsequent filtration through a paper much easier. An open glass vessel, or glass beaker, is taken, and a glass funnel is put into it, so that the tube of the latter reaches nearly to the bottom; the filter is then

357. In the preparation of the sensitive films, a first liquid should be made as follows:

Albumen (fresh eggs),	180	grammes	(5 ozs. 6 drs.)
Water,	150	"	(4 " 7 ")
Bichromate of Potash,	4	"	(1 dr.)
Ammonia,	100	"	(3 ozs. 2 drs.)

The alkaline bichromate, reduced to powder in a porcelain or glass mortar and added to the mixture of water and ammonia, rapidly dissolves in it; the albumen is then poured in, this last having previously been whipped to a froth, allowed to rest, and filtered with care. This liquid passes quickly through filtering paper. The mixture may be used until exhausted, but should not be kept for too long a time. The albumen would lose its solidity, even after having been strongly coagulated by the bichromate of potash, under the action of the light.—Leon Vidal.

The following is a good substratum:

Pure Albumen,	5 ounces.
Bichromate of Ammonium,	25 grains.

Add the bichromate and beat all to a froth, and let it stand over night, and then neutralize the acid bichromate with a few drops of ammonia, and filter several times. Apply with a

fitted with soft and thick filter-paper, and the mixture poured in. The pores of the paper are very speedily stopped, and the process of filtering is suspended; for this reason the solution is poured from the funnel back again into the glass vessel, the filter-paper is replaced by new, and the solution again passed through it. This operation will have to be repeated several times before all the liquid in the vessel has gone through the filter. When the liquid has been once filtered, it can be easily submitted to a second operation without the filter-paper being changed. For this reason the filtered liquid is poured into another glass and filtered a second time. As the first filtrate always contains a few hairs or fibres, the liquid that passes through first of all should always be poured back to go through the filter again, and in this way a perfectly clean liquid, free from bubbles, is obtained. To prepare the plates a sheet of glass of large size is laid down horizontally, and on it is placed one of the mat plates, which has, first of all, been dusted with a brush. Upon its surface, and near the

brush, and dry by slow heat or spontaneously, and expose the glass side to the light on a black cloth till a piece of silvered paper turns black; then put in the dark, for use when wanted. Or this substitute may be used:

Albumen,	2 ounces.
Silicate of Soda,	1 ounce.
Gelatin,	60 grains.
Bichromate of Potash,	40 "
Water,	20 ounces.

To the prepared albumen, two ounces, add five ounces of water. Now add five ounces of water to the silicate of soda, and mix them, pouring the soda into the albumen, stirring slowly all the time. Now add the gelatin and bichromate of potash to the remaining ten ounces of water, and dissolve by heat in a water-bath, being careful not to raise the heat above 120°. Then add the albumen and soda, mixing thoroughly. Filter, and flow the plates, and set away to dry spontaneously, free from dust. When about to use, immerse the plate in a dish of water about five minutes, then rinse and dry. Now place in the oven and heat to 100°; then take the plate on the spread left hand and coat with No. 2. —ARTOTYPER.

The method of filtering the albumen by the Artotype Company is to tie a piece of clean chamois skin over the top of a funnel; after moistening with pure water, the albumen is carefully poured upon it; after filtration, the bichromate of potash is added, which may first be dissolved in a small amount of water. The less water in the substratum, the less liable to blister when it comes to be printed; only enough ammonia is used to preserve the albumen, and need not be used when the solution is used immediately. A piece of polished French plate-glass is carefully cleaned, as carefully as for making a negative; a perfectly clean flat brush, about three inches wide, is dipped in the solution, the surplus albumen removed by drawing once or twice over the edge of the dish. Now balancing the glass on the thumb and forefingers of the left hand, draw the brush containing the albumen diagonally across

edge, is poured some of the solution above described, and this is spread over the plate by gently inclining it. Those parts which are not wetted in this way are afterwards covered with the liquid by spreading it with a strip of paper; but, in any case, the liquid must not be allowed to flow quickly, but gently in a line downwards. Another vessel is brought to one corner of the plate, and there the glass is quickly turned on end, so that the superfluous matter runs off. The quick withdrawal of the liquid carries away any air-bubbles which may have been formed when the fluid was spread with the paper; but if any should yet remain, a little more of the filtered solution is applied, and then again rapidly drained into the second vessel. The plate is permitted to drain, and is set up against the wall to dry. The fluid which has been poured off the plate must be filtered again before use. In this way a large number of plates may be prepared, and, in this condition, may be kept for six months. They must never be used immediately, but should remain a day or two before being employed. The longer they are allowed to remain, the better they are.

the plate, commencing at the upper right-hand corner, then diagonally across the plate in the opposite direction, after which the operation is repeated, going both ways square across the plate. The plate is next placed in the drying-oven, which is kept at an even temperature of about one hundred and thirty-five degrees; from twenty to thirty minutes are required to dry the plate. After the substratum is dry, the plate is placed with its albumen side down upon a board covered over with black cloth, and exposed to a diffused light until a piece of silvered paper placed by its side is pretty well blackened, when the plate is removed to the coating-room and solution No. 2 is applied. To apply solution No. 2, first have the plate warmed to the temperature of the drying-box, then holding the plate with the left hand, the same way as No. 1, pour upon and entirely across the upper end of the plate just enough of the bichromate solution to cover the plate, then slightly tilting it with the flat side of the little finger cause the gelatin to flow evenly the whole length, then drawing the little finger around the edges of the plate, cause the solution to flow to the edges all around. If there is a surplus gathered at the lower corner, turn it off the plate, and place the plate in the drying-oven to dry, which will take at least half an hour. Solution No. 3 consists of bichromate of ammonia, gelatin (same as in No. 2), chrome-alum, glycerin, and water. It contains about as much bichromate as in the preceding solution. The chrome-alum is to harden or toughen the film, and the glycerin to keep it from becoming too brittle; only a trace of glycerin is used. This solution is made and used the same as No. 2, only in coating the plate the solution is poured upon the opposite end, so as to equalize the thickness of the coating. When again dry, the plate is placed in the printing-frame and printed in the usual way, and the progress of the printing examined from the back; experience will soon tell when they are sufficiently printed. They are then placed in running water of from seventy to one hundred degrees temperature, and left until all traces of the bichromate is washed out; when, after being again dried, they are wet up and put in the press and printed from.—"AN OLD SUBSCRIBER" *in the Philadelphia Photographer.*

358. Second Preparation.—To coat the plates with gelatin, they must first of all be thoroughly rinsed with cold water, best under a tap, but without the prepared side being touched. They are then dried, and ready to be treated with gelatin. This is done in the following manner: a box having a sheet-iron bottom, and a cover of dark linen or cloth, is provided; inside, three inches above the iron bottom, is a frame, spanned with linen, exactly the size of the interior, and this is covered with filter-paper loosely laid upon it. This frame should equalize perfectly the unequal temperature of the iron below, for under the box is fitted a gas or spirit flame. Three inches under the lid are iron rods from one side of

358. Now make a second sensitive liquid, that which forms the printing film, as follows:

Gelatin, ...	90 grammes	(2 ozs. 7 drs.)
Water, ...	720 "	(22 " 4 ")
Fish-Glue (true), ...	30 "	(8 ")
Water, ...	360 "	(11 ozs. 4 ")
Bichromate of Potash, pure, or of Ammonia, .	30 "	(8 ")
Water, ...	360 "	(11 ozs. 4 ")

The gelatin is put to swell twenty-four hours before operating, as is also the fish-glue. Then these two substances are dissolved separately in their water, over a water-bath. The gelatin will dissolve at a temperature of from 40 to 60° C. (104 to 140° F.). As to the fish-glue, it will be necessary, in order to dissolve it, to increase the heat to the boiling point, and even then a complete solution will not be attained. These two solutions are filtered in a clean recipient through a rather coarse cloth, and then the solution of bichromate is poured into the same filter.

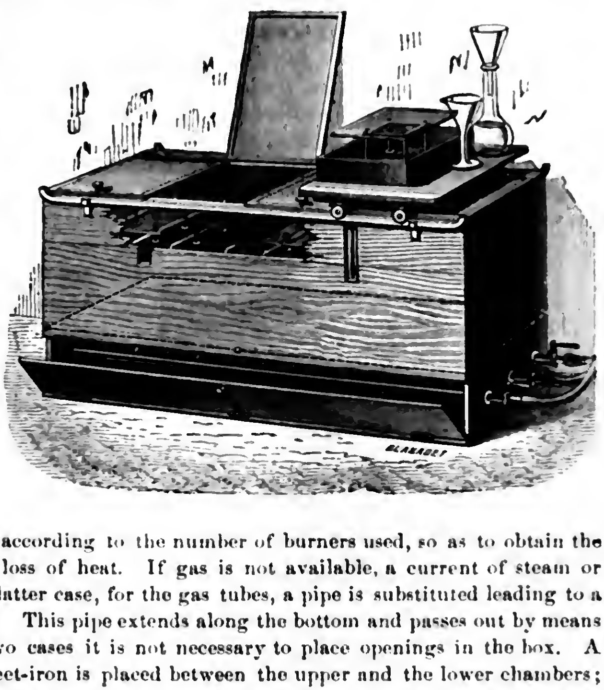
Fig. 103.

The apparatus contrived by Mr. Brewer to filter the gelatin whilst hot is very useful, and consists of two distinct parts: 1. A glass funnel, the tube of which passes through a cork. 2. A copper receiver, forming a jacket for the funnel, and holding the water, which is heated by a gas-burner or an alcohol-lamp, as is seen in the cut (Fig. 103). In case of accidental breakage, the glass funnel is very easily replaced.—Leon Vidal.

the box to the other, placed horizontally, each rod being furnished with two or three holes, into which screws are fitted, upon the heads of which the glass plates rest. By turning these screws so that the heads are raised or depressed, the plates are easily brought into a horizontal position. A thermometer suitably fitted into the side of the box indicates the temperature. Two, three, or more glass plates are laid horizontally upon the

The drawing below gives an idea of the drying-box in which are prepared the phototypic plates. This is divided into two distinct parts: First the lower chamber, having a number of gas-pipes, pierced with holes, running through it at equal distances and forming a grating. Two or three of these pipes are sufficient to give the proper heat, even when it is necessary to raise it over 150° C. (302° F.) A stop-cock is attached to each pipe so that it can be used independently of the others. This chamber is closed by a door extending the full length to facilitate the lighting, cleaning, and repairing of the tubes. One or more openings made at the two ends of the heating chamber allow the air to enter that is necessary for the combustion of the gas.

FIG. 104.



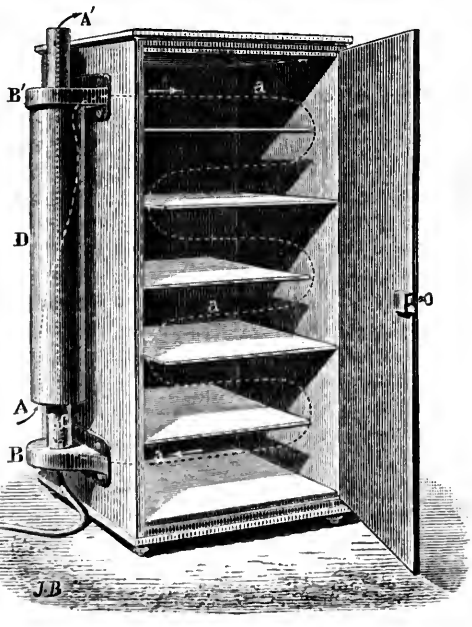
These openings are regulated according to the number of burners used, so as to obtain the desired effect without useless loss of heat. If gas is not available, a current of steam or hot-air may be used. In the latter case, for the gas tubes, a pipe is substituted leading to a stove which furnishes the heat. This pipe extends along the bottom and passes out by means of an elbow. In the last two cases it is not necessary to place openings in the box. A metallic division of strong sheet-iron is placed between the upper and the lower chambers; this is the dryer proper. This division or apartment, which is hermetically closed, is necessary to prevent the dust, which would be carried by the current of hot-air, from falling on the gelatinized plates, to the great injury of their surfaces. Towards the middle of the height of the upper box are placed two longitudinal strips, made of wood, and nailed against the two opposite sides of the box. On these strips rest transversal iron bars having three or four screws, as is seen in the cut, at suitable distances, to divide the strips into three or four equal parts. These screws serve to wedge the plates which are placed on their upper angles, and which are adjusted by means of a spirit-level. As many bars are used as are necessary to cover the entire surface of the dryer.

Now, everything being on the movable platform, commence with the first plate. It is

screws, the box is closed, and the temperature raised to 30° Reaumur. In the meantime, a quarter of an ounce (7.5 grammes) of the finest French gelatin is taken; five ounces (150 grammes) of distilled water are poured upon it, and the gelatin allowed to swell for an hour. After this the gelatin is dissolved upon a water-bath, and when it has reached a high temperature (say 70° R.), fourteen grains (0.875 grammes) of bichromate of

covered with the gelatinous liquid, put back in its place, and the lid instantly closed. The platform is pushed forward a length, the second lid is opened, the plate receives its preparation, put back in its place, and the second lid closed, and so on with the rest. When the dryer is regularly heated to 35° C. (95° F.), it requires at least two hours for the complete desiccation of the plates. It is well to make sure if the operation is ended by opening the lid corresponding to the last preparation. If the plate in this part of the box is dry, all the others are certainly so, and the heat should be suppressed. The plates should be allowed to cool slowly, and may be exposed as soon as cold. In the summer the operation in the dryer may be done in the morning, and the plates exposed in the afternoon. The plates are allowed to disgorge during the same day, and on the following morning they may be printed from. The dryer should be kept in a room the glass of which is covered with yellow paper, or, what is still better, with a pellicle covered with chrysoidine confined between two sheets of glass. The interior of the dryer should be carefully cleaned, from time to time, with a damp sponge to remove the dust, and to render this operation easier it is well to line the sides of the upper chamber with zinc.

Fig. 105.



There is another kind of dryer made by Mr. S. Rogers, described in the almanac of the *British Journal of Photography* for 1870. As Fig. 105 shows, a burner, C, furnishes a current of hot air, which follows the direction indicated by the arrows. The air in the jacket, A D B′, which surrounds the tube, C A′ is heated by the combustion of the burner, C; it enters from above into the dryer *a a* by an opening made in the side B and A′; thence it passes in, descending over all the horizontal separations which are arranged in such a manner as to receive in all their length a current of hot air. Having reached the bottom it makes its exit by an opening leading directly into C, and by increasing the current materially aids the combustion. The exterior air enters the bottom of the jacket by a small opening at A. The

ammonium and ten grains (0.625 grammes) of chloride of calcium are added; finally, after everything has dissolved, an ounce (30 grammes) of ordinary spirits of wine is added, and the mixture filtered. The filtered solution is poured upon the warmed glass plate, and spread over the surface by means of a strip of paper. Not too much, nor too little liquid must be applied, but only so much that when the plate is inclined only a little of it betrays a tendency to run off. When the operation has been carried out several times, the proper amount to be applied is easily guessed. Too thick a film does not last in printing, as the scraper abrades the sur-

closet of the dryer is furnished at the bottom with adjusting screws, so as to permit the levelling of the interior separation at one operation.—LEON VIDAL.

2.—Gelatin,	1 ounce.
Bichromate of Potash,	70 grains.
Water,	20 ounces.

In winter from 10 to 20 drops of glycerin may be used. Soak the gelatin in 10 ounces of water for an hour, then add the remaining 10 ounces of water and the bichromate of potash. Heat to 100°, stirring until dissolved; then filter several times, and it is ready for coating the plates. When warmed to 100°, the plates will dry in ten to twenty minutes. Then cool off slowly, and they are ready for

3.—Gelatin,	1 ounce.
Russian Isinglass,	$\frac{1}{4}$ "
Water,	24 ounces.
Alcohol.	4 "
Bichromate of Ammonium,	90 to 120 grains.
Calcined Magnesium,	10 to 20 "
Chrome-alum Solution,	1 to 2 drachms.

Dissolve the isinglass in 6 ounces of water by boiling from one to two hours, and the gelatin in 8 ounces of water, in water-bath at 100°, and add the alcohol and remaining chemicals to the remaining 10 ounces of water, except the chrome-alum solution, which should be added last, and on the day of use only. Do not raise the heat in any case above 120°. With solution No. 3, coat the plate precisely as with No. 2, except that the solution should flow off the opposite corner. Let the plates stand for a few hours after they are removed from the oven, and then expose under the negative to diffused light the proper time. The chrome-alum solution is made as follows:

Chrome-alum,	40 grains.
Bicarbonate of Potash,	20 "
Water,	5 ounces.

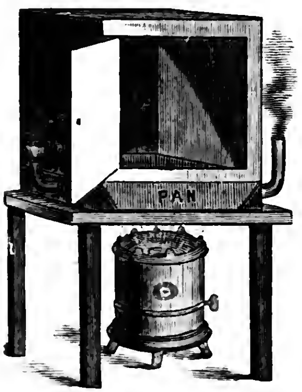
"ARTOTYPER."

Professor Husnik's method of making a substratum on the glass plate for the gelatin film is an excellent one, and the best so far published; but it has been improved (and this is the method adopted by the Artotype Company) *by drying the film at once in the oven used for drying the gelatin film*, at a temperature of about 150° F.; this enables the plate to be used at once for the gelatin, the heat causing the mixture of silicate of soda and albumen to coagulate in less than half an hour and adhere very firmly to the glass. The best oven

face; and too thin a film, on the other hand, permits the fine grains of the glass to appear as little black spots, the force employed in the press being the greater. When coated, the plates are put into the box and allowed to dry at a temperature of 35° R. Plates prepared to this stage will keep good in summer for the space of a week, and in winter-time for a month, becoming better after keeping a little while.

for the purpose (and the one used by them) is made by simply making a simple wooden box, about thirty inches square and five feet high, the bottom formed by a *closed*, *flat*, *hot-water pan*, *made of metal*, about four inches deep, and having two pipes leading outside, one for the escape of steam and one to pour water into. A gas- or kerosene-stove is put underneath, and, if it has been carefully levelled, two thicknesses of blotting-paper are put on top of the pan, on which the plates are to be laid. Several more rows of glass can be put in by means of strips laid across at intervals, with levelling-screws attached. One side of the box is a door. The drawing will give something of an idea. The albumen and silicate solution should be carefully spread over the cleaned surface of the plate (in a room absolutely free from dust), the excess allowed to run off, and then laid in the oven at a temperature of 140° to 150°, and allowed to remain about twenty minutes or one-half hour. It is better to keep these plates a day before using, but when dried this way, they may be used at once. They must then be rinsed under a tap and dried again, when they are ready to receive the gelatin. The oven must be brought up to at least 180°, the plates carefully levelled, and then the gelatin mixture is to be applied, by pouring on in the centre until it just spreads to the edges of the glass, *but no more;* experience is necessary in this. The method now practised in Europe is to pour off the excess, and pour on again, and then pour off *all but a little of the excess*, and allow to dry. This avoids any air-bubbles, and also too thick films. The thicker the film, the coarser the grain, and more intense the blacks. The thin films give the best detail, but too thin ones yield flat prints. The Artotype Company (and so does Albert) replace about one-third of the gelatin with Russia isinglass, which is better than pure gelatin; the latter must be of the kind known as the "Magdeburg" a German make, which does not swell much in water. The plates will require about twenty minutes to a half hour in the oven, and during this time the door should not be opened. As soon as dry, they are ready for exposure; this must be learned by experience, and varies with the negative. After exposure, it is washed thoroughly under a tap till all the unreduced chrome-salt is washed out, and again dried, when it is ready for the press. I wish here to remark, that the Russia isinglass requires to be boiled two or three hours, and then the insoluble residue must be separated from the solution before adding to the gelatin. It is also unnecessary to grind the glass, as recommended by Professor Husnik. It will also be found better to dry the gelatin film at about 200° F. than any lower; the high temperature gives a finer grained film. In order to produce a larger number of impressions from a plate, several modes of hardening (notably with chrome-alum) have been patented, but it is not

FIG. 106.



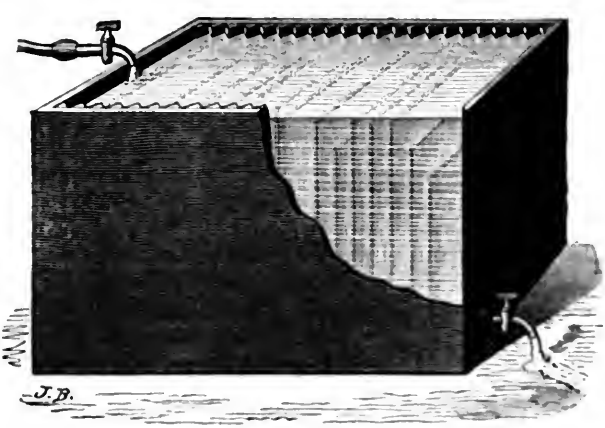
359. THE EXPOSURE.—This may be estimated at three-quarters of an hour in the shade, in the case of a good negative, or a quarter of an hour in the sun. Diffused light gives the best half-tones. After exposure, the chrome-salts, which have not been acted upon by light, are washed out with water, and the plate well wiped and put to dry. After three hours, the plate may be employed for printing purposes.

360. PRINTING.—The plate is fixed by means of plaster of Paris to a lithographic stone, and printed by the aid of a lithographic press. The

essential. You can dispense with it, and get along without infringing on any patent. On a flat marble slab in the press plaster is poured, and a plate glass of suitable size pressed on and allowed to set; on this plate glass the exposed plate is put on by capillary attraction with water; it is then ready to be inked and printed. As a sensitizer for the gelatin, I prefer the bichromate of ammonia, and I would strongly recommend one grain of salycilic acid to the ounce of solution, as a preventive of trouble when the weather is favorable to decomposition.

To strip negatives for lichtdruck purposes, etc., the glass must be carefully cleaned and polished with soapstone powder, or, still better, with a five-grain solution of pure wax in pure benzole. Polish with a Canton-flannel rag. After the negative is thoroughly washed, put it in a dish of clean water and soak a sheet of fine gelatin such as the dealers sell for printing borders for carbon prints, until it lays flat, but no longer; press on the negative under water, squeeze out the water and air-bubbles with a rubber squeegee, and lay it flat, face up, to dry in a place free from dust; when dry, it comes off the glass, taking the collodion film with it.—D. BACHRACH, JR.

FIG. 107.



359. After exposure, the sensitized plate is removed from the frame and placed at once to disgorge in a grooved tank filled with water, which is renewed, if possible, by a continuous current. The annexed figure will explain the kind generally used in France and Germany.—LEON VIDAL.

360. THE PRINTING.—The most delicate work in the application of the process for impressions made with fatty ink consists in printing from the plate when it is in a perfect condition to receive the ink in the exact proportions necessary to give the identical value of the negative. A good lithographer will soon become familiar with this operation, and he will

plate is moistened and treated with two different inks or colors, one thick one to blacken the plate, and one having a brownish tone, which gives the half-tones. After every printing, the plate is again wetted and wiped with a rag, when the inking is proceeded with once more. If the plate gives but little half-tone in the shadows, a blind proof is taken off, which takes off the last remnant of the color, and then the plate is wiped once more and printed. A plate of this kind should furnish six hundred prints or more. The permanency of the plates depends upon due attention being given to their preparation, upon having gelatin that swells but little, and employing little force in printing. Some operators replace a portion of the gelatin with isinglass. This substance is to be obtained, as a rule, only of inferior quality, and is very dear; the bleached material is perfectly valueless, and the only quality to be recommended is the Russian.

meet with success if he possesses taste and knows what a good print is. In order to guide the printer, it is well to place before him a good print, made with chloride of silver on albumen, from the negative which has impressioned the gelatin film. He will there find all the value of the negative, and it will be easy for him to know if he is to use more or less ink, in order that his print should resemble, as much as possible, the one made with the silver salt. This is a question of care and taste rather than of skill. If the time of exposure to the light has been suitable, the printing will necessarily be good. It is important to note that it is very difficult to obtain, in the blacks, the transparencies that exist in the albumen print. The fatty ink when dry is mat, and it is only by passing a varnish on the surface that it is possible to preserve the transparency of the strong shades. The character of the cliché used naturally plays a very important part in view of the result to be obtained, and that is the reason that it is difficult for the printer to know what he can obtain from his plate, if he does not have before him a print made from the cliché. As soon as the operator has obtained a print which he thinks to be as good as possible, he should place it alongside of him, as a type, to serve as a comparison with all the other prints as they are successively made. By this means he will discover if too much ink is used, or if there is too much hardness, and it will be easy for him to correct these faults, either by hardening the ink on his table, or by adding to it a small quantity of varnish to render it harder and more suitable for producing the half-tones. If, notwithstanding this last care, very decided whites should show themselves, he must conclude that the gelatin is too moist, that it has absorbed too much water, and he should stop the printing in order to allow a portion of this excess of moisture to evaporate, unless the defect be the consequence of under-exposure to light, which is irremediable. If, on the contrary, the print be too black; if the half-tones are too heavy, even with very hard ink, it is because the plate lacks moisture, or that there has been over-exposure to light. In this case the saturation of moisture should be increased by adding to the water a very small quantity of ammonia, or else a few grammes of ox-gall.

It is well understood that this liquid should be passed over the plate after it has been cleaned with spirits of turpentine. When it is desired to give more brilliancy to the print, we may leave covered the blacks protected by the printing ink, and only wash the whites. The image thus will offer more contrast, but this effect is not maintained. According to the

The choice of colors is important. If a brown tone is desired, then Munich varnish must be added to the black ink. This has the defect of coloring the plate, so that in the end it is not white, but brown. This varnish has the effect, also, of tanning the gelatin, and the prints soon appear flat. A good brown mixture is afforded by the finest printer's black of the thickest kind, mixed with red oxide of iron and a little Casar varnish. To preserve the margins perfectly white, the negative is covered up to the image or design. On printing, fine tissue-paper is cut into bands of two or three inches breadth, and these are put on the edges of the plate, which are to remain clean before the printing-paper is applied. Or a frame may be employed, the aperture of which represents the size of the plate, and over this is stretched tissue-paper saturated with paraffin,

nature of the gelatin, and especially according to the more or less adherence of the film to the rigid support, the number of prints obtained from a plate may be set down at only fifty or sixty, or it may reach from five hundred to one thousand, and even more. The care given to the printing contributes in a great measure to the duration of the plate. The rollers should be kept scrupulously clean and protected from dust or any hard grain which would infallibly mark the gelatin film. The cloths used in wiping, the sponge, the water itself, should be clean, so as to avoid stains and scratches. When the printer perceives that the print has a tendency to fog, it suffices, as we have just said, to make the gelatin film absorb a greater quantity of moisture; but, before wetting, any fatty ink that may have remained on its surface should be removed by washing with spirits of turpentine. The cloths used for wiping with the turpentine should be different, and kept in a receptacle separately from those used for wiping with water or the glycerin liquid. As much as possible fatty essences should be avoided, so as not to encounter too much trouble in wetting with water, which, otherwise, repelled by the fatty body, wets with difficulty the surface of the film, rendering it necessary to repeat the operation several times to render it complete. When the absorption of the water is unequal, we perceive marbled markings on the prints which injure the image, and which can only be removed by longer and more regular wetting. When this accident occurs, there often results a serious loss of time, and it is even necessary sometimes to abandon, momentarily, the stained plate to restore it to good condition, whilst another one is being printed from. The different kinds of paper used, the more or less pressure, and fulling, or underlaying, as the printers call it, are conditions of success or failure. It is, therefore, necessary to take all these details into consideration.

It is evident that a plate inked in the same manner will produce different results, according as the paper is granulated or smooth, laid or not laid. In causing the pressure to vary, the result will also vary; it should be regulated so as to remove all the ink from the plate. Fulling, or underlaying, assists in obtaining this last result in those cases in which there are hollows to be filled by the paper. This fulling is obtained by placing between the cylinder and the paper to be printed on, some sheets of paper or a sheet of vulcanized rubber. If the surface of the plate does not offer any depression, it is not necessary that this fulling should be very decided. However, we advise to never use a substance that is too hard, such as fuller's- or bristol-board, in order to avoid accidents that frequently occur on the surface

and an opening the size of the picture is cut out, and this frame of paper, made just the size you want the print to be, is laid upon the plate every time an impression is struck off. By this means a regular edge is preserved and all smearing of the ink upon the margin is avoided, two desirable things which should never be neglected.

361. After the prints come from the press they often need considerable "spotting out," which is done in a manner similar to that practised with albumen prints. They are then ready for delivery to your patron, provided he is content with a mat surface only. If the desire be to make them resemble albumen prints, so far as having a shining surface is concerned, then they must be varnished, which operation certainly adds to their cost, and lessens their liability to be injured by moisture more than

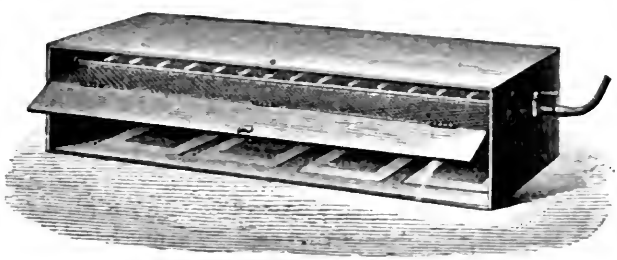
of the plate when hard substances are carried either by the ink or the air in motion. If there is fulling, a portion of the effect will be produced in the thickness of the cushion, whilst in the contrary case it is the gelatin film which receives all the injury by a depression of the film, and then by a rapid removal of the surface, if the coating does not perfectly adhere to the plate.—Leon Vidal.

361. Varnishing and Mounting Phototype Prints Printed without Margins.—Phototype prints that are to be mounted on card- or bristol-board, may be allowed to retain their mat appearance, or they may sometimes be varnished to give them more transparency and brilliancy, and more often to assimilate them in appearance with the ordinary photographic prints. In the first case, it suffices to trim the edges of the prints and stick them with paste on their final support, which has been previously dampened, so that they will dry evenly and without cockling. When sufficiently dry, the sheets are passed through rollers so as to incorporate the print with the board, and to obtain a polished surface. By this means the phototype print acquires more solidity, and the ink is less liable to rub off by friction. It is a kind of fixing. The polishing should not be done until the fatty varnish becomes sufficiently hard and dry to resist the pressure of the rollers. The prints to be varnished may be of two kinds, according as they are printed on laid or unlaid paper. If the paper is laid or albumenized (to be afterwards coagulated), it may be varnished at once, without having to fear that the varnish will penetrate the paper. But if the paper is not covered with a protecting coating, it is indispensable to gelatinize it before using the varnish. The gelatinizing is done with a brush, using a tepid solution of ten per cent. of white gelatin in one hundred grammes (three ounces two drachms) of ordinary water. The gelatin is evenly spread with a large flat brush, avoiding air-bubbles as much as possible. With a little practice this operation is easily learned. The gelatinized prints are stuck with thumb-pins, two together and back to back, on strips of wood edged with cork, and when dry are varnished. The best varnish to be used is that which, whilst remaining white, is capable of giving a hard coating, and one difficult to scratch. We prefer white gum-lac dissolved in methylic alcohol at fifteen per cent. When the gum-lac is placed in alcohol, it will be remarked that the solution is rendered turbid by fatty substances held in suspension. If, as indicated by Mr. Peltz, powdered lime be added, we obtain a solution three-fourths of which are limpid, and what remains filters rapidly even through a felted cloth. We can also use one part essence of

it improves their appearance. As has been explained, the prints may be supplied with a margin of white paper, or they may be trimmed and mounted the same as photographs. If the latter operation is to be performed, then care must be taken that no moisture strikes the surface of the prints, lest they be soiled and spoiled.

petroleum or benzine for three parts of varnish. Two strata are formed: the first contains the fatty matter which is thus eliminated. It is well to separate the fatty body, otherwise filtration is very slow and the varnish lacks brilliancy. This varnish is carefully put on with a tuft, so as to avoid air-bubbles, and as soon as the print is coated it is placed in a special drying-box, represented by Fig. 108. This consists simply of a rectangular, sheet-iron box, about 1 meter ($39\frac{1}{3}$ inches) in length, and .25 meter (10 inches) in height. A gas-tube, pierced at distances of from 6 to 8 centimeters ($2\frac{5}{12}$ to $3\frac{1}{8}$ inches), extends the whole length of the upper portion of this box, whose front is open at two-thirds of its height; a wire-cloth separates the upper third portion from the other two, forming the interior partition of the chamber through which the grating extends. The front partition of this chamber is provided with hinges, in order to light the burners. The plates are placed in the lower open portion, resting on the bottom. The varnish dries rapidly and the wire-cloth prevents the volatilized alcohol from taking fire. With an apparatus of this kind it is possible to varnish very rapidly a great number of prints. Nothing more remains to be done than to trim them and stick as usual. Care must be taken, however, to avoid destroying, in a measure, the appearance of the varnish by the swelling of the paper, to not wet it too much with the paste, and especially to not allow it to remain too long a time with the back covered with paste before mounting. After drying, polish as has been explained above. To avoid gelatinizing, we might, after the prints are sufficiently dry, pass them separately over the surface of a liquid thus composed:

Fig. 108.



Water,	500 grammes	(16 Troy ozs.)
Borax,	130 "	(4 " 1 dr.)
White Gum-Lac,	100 "	(3 " 2 drs.)
Carbonate of Soda,	6 "	($1\frac{1}{2}$ ")

Dissolve the borax and carbonate of soda in boiling water, and add the white gum-lac by small bits; filter with care. The prints passed in this bath, when cold, are stuck in pairs, back to back, on strips having points for the purpose, and when dry they may be varnished with the aid of heat. In this manner there is nothing on the surface of the image but gum-lac, without the interposition of an organic matter, such as gelatin, liable to become soft by dampness, to mould and injure the paper, and consequently the image that it carries. In winter it is best to wet with the gum-lac in a rather warm room, and the bath itself should be

362. The fugitiveness of silver salt prints, such as have been considered in Lessons M to S and W, has compelled a great deal of research and experiment to find a process by which unfading prints could be made. The carbon process has had a long trial, but has not succeeded in getting much of a foothold. The Woodburytype process is a most ingenious one,

kept at an average temperature of from 15° to 20° C. (59° to 68° F.). It is also possible to stop the pores of the paper, which is to be varnished, by a slight *parchmentizing*. To do this, prepare a mixture, cold, composed of

Water,	1 part.
Sulphuric Acid,	2 parts.

The sheets are immersed for a very few moments in this mixture, and then rapidly plunged into a great quantity of cold water. To completely neutralize the effect of the acid, washing may be finished in a dish containing water to which a small quantity of ammonia has been added. To avoid cockling, the parchmented paper should be dried under pressure, or by stretching the sheets upon frames. This mode of preparing the paper may suit in certain cases owing to the diaphanous appearance which it gives to the paper—very pleasing in some kinds of prints. Care must be taken to avoid pushing too far the action of the acid. It is sufficient to obtain the effect on the surface of the paper. The varnish will always remain on the parchmented surface, but it should be put on whilst the image is stretched, so that the heat necessary for the varnishing should not cockle the prints and render them unfit for mounting.—LEON VIDAL.

362. The instructions for working the platinotype process are given now in detail. A general description of the process is not necessary. It is in brief as follows: The sensitized paper, containing only salts of iron and platinum, is exposed under a negative or in the solar camera in the usual manner; it is then floated for two or three seconds on a hot solution of oxalate of potash; after this it is washed in a weak solution of acid, and finally in water.

SENSITIZING.—This operation is a very important one, and upon it the success of the printing mostly depends. Failures are in most cases referable to errors in sensitizing. Sensitizing should be conducted in a room lighted by a yellow or very feeble white light, or by gas. For contact printing the sensitizer is made by dissolving sixty grains of the platinum salt in one ounce of the iron solution. To facilitate the solution, stir with a glass rod until all is dissolved. Use as soon as made, otherwise decomposition is likely to occur, especially in warm weather. As a rule, the solution will keep good for half an hour. Sensitizing solutions which have decomposed give flat prints with impure whites. For contact work on the smooth 18x22 inch paper, a little less than two drachms of the sensitizer is sufficient to coat a sheet. The paper should be placed face upwards on the special glass topped table and secured there by the side springs. A little less than two drachms of the sensitizer should be put on the middle of the sheet; it should then be spread over the surface in as even a manner as possible by the special squeegee. For contact work on the sized rough paper, the same quantity of the sensitizer may be employed, but the coating is better distributed by means of a small pad of flannel made soft by a tuft of cotton placed inside. As soon as sensitized, the paper should be hung up by two corners until the moisture has disappeared from its surface; this should take ten minutes; it should then be made *perfectly* dry by warming before a fire or stove. (It is of the utmost importance that the paper be made thoroughly dry.) Sufficient time

but has also failed to meet the requirements of the every-day printer. The salts of platinum have been tried and found of much service, and so directions are given below for the practice of his method with platinum, by Mr. W. Willis, Jr., the inventor and patentee.

should elapse between the sensitizing and drying. If the paper be dried too soon, some of the image will float off in the developing bath. On the other hand, if it be not dried, say within twelve minutes after sensitizing, there will frequently be a tendency to flatness, and the image will probably be too much sunk in. When the air is very dry, it is necessary to create a moist atmosphere in the sensitizing room by watering the floor or walls, in order to prevent the paper from becoming too rapidly surface dry. A damp cupboard or damping-box may be used for this purpose. For solar work and for prints to be finished in crayon, ink, water-color, or pastel, the sensitizer is made by dissolving forty grains of platinum salt in one ounce of the iron solution. Use at once. Three drachms of the sensitizer are sufficient to coat a 25 x 30 inch sheet. The paper should be placed on a plate of glass and held in position by clips. The sensitizer should be applied to the sheet, by a tuft of clean cotton wool, in as even a manner as possible. When the sheet has been sensitized, it should be allowed to become *surface* dry and then be *perfectly* dried before a fire or stove or in a hot drying cupboard. For solar work five to eight minutes are sufficient for drying. To prevent streaks and stains, the flannel should be removed from the squeegee as soon as sensitizing is completed, and washed in the clearing solution and then in water; flannel pads must be treated in like manner; tufts of cotton employed for solar work should be discarded and fresh ones taken every fifteen minutes; sensitizing tables must be kept perfectly clean.

Exposure.—The correct exposure is ascertained by inspection of the paper in a very weak light in the usual manner. As a general rule, the exposure is complete when the *detail in the high-lights* becomes *faintly visible.* As soon as exposed, the print should be placed in a tin can containing a little dry chloride of calcium, to preserve it from moisture until developed.

Development.—Development should be conducted in a feeble white light or gas-light. It may be proceeded with immediately after the print is exposed, or more conveniently at the end of the day's printing. The developer is made by dissolving one hundred and thirty grains of oxalate of potash in each ounce of water. A large quantity of this solution may be made up. It will keep indefinitely. The solution should be made faintly acid by oxalic acid. Contact prints are developed by floating the printed surface for a few seconds on this developing solution, which is conveniently contained in a flat-bottom dish of enamelled iron or porcelain, supported on an iron tripod. A Bunsen burner, with rose-top to spread the flame, forms the best means for supplying the heat; or a spirit lamp may be used. A temperature varying between 170° and 180° F. is the standard temperature for the developer. For prints on rough paper, it is better to stir up the developer between each development to destroy any scum which may form. To develop large solar prints, a V-shaped earthenware or enamelled iron trough should be used. The developer should be heated in this trough by a row of small gas jets placed underneath, or by any other convenient device. The print is developed by being slowly and steadily drawn through the liquid at the bottom of the trough; it is held under the surface of the liquid by a heavy glass rod; this glass rod revolves as the print is drawn under it.

Clearing and Washing.—The developed prints must be washed in *two* baths of a weak solution of citric acid to clear them. This solution is made by dissolving one ounce of citric

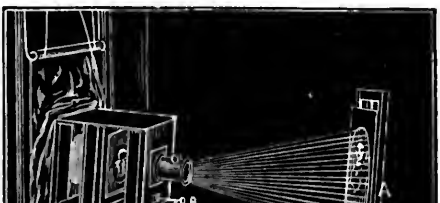
363. In some parts of Europe, and to a more limited degree in America, pictures known as "collodion transfers" (given also the trade name of "megatype") have been introduced with some success. A negative is made in the usual way, and from it an enlarged collodion positive is made, the film of which is transferred to a sheet of gelatinized paper, usually, and finished in India-ink or oil-color. Without being thus finished, unless delicately toned, they are gray and unpleasing in color, and have no quality to recommend them.

acid in thirty ounces of water. As soon as developed, the prints should be immersed face downwards in the first bath of acid, and after they have remained in it for about ten minutes they should be removed to the second bath, in which they should remain another ten minutes. The first bath may be used for two batches of prints. The second acid-bath must always be fresh. This bath may be used again as the first bath for a succeeding batch of prints. *On no account should the prints be placed in plain water on leaving the developer.* After the prints have passed through the two changes of acid, they should be rapidly rinsed, and then well washed in two or three changes of water during about half an hour. They are then finished. The object of this washing in acid and water is to remove the iron salt with which the paper is sensitized.

Precautions against Damp.—To secure the most brilliant results, the sensitized paper *before*, *during*, and *after* its exposure to light, should be kept as dry as possible. It is of the first importance that the printing-frames and pads be quite dry. Between the sensitized paper and the pads a thin sheet of vulcanized India-rubber may be placed with great advantage. The effect of damp is seen in a want of vigor, a general muddiness of tone, and, where the sensitized paper has been exposed to its influence for some days, in the impaired purity of the whites. Paper in a damp state takes much longer to print than dry paper.

363. The principle is just the same as that of the reflecting solar camera without the reflector or condenser. A long-focus objective is, perhaps, the best for full figures. The camera-box should be about fifteen inches square and eighteen inches long. Fig. 109 will make it plainer. F is a board fifteen inches long, to which the box is fastened; A is the easel, which slides on the board to or from the lens, according to the size you want to enlarge; B is a rod of wood, or iron is better, which is fastened to the carrier inside the box, into which you slide your negative. You focus (after your easel is far enough away to give the size you want) by moving the negative-rack by means of the rod B to or from the lens inside, until your image is sharp on a glass covered with white paper, placed on a ledge on the easel; remove this glass, and place your sensitized plate in the same place, and time about one minute, or according to the density of your negative; of course, there must be no white light in the room.—J. H. Folsom.

Fig. 109.



864. Artificial light may be used by those who have a magic lantern at their service and not enough time while the sun shines to do the work. The ordinary bath may be used, though it is just as well to reserve a bath for this use only. Not that it is necessary in order to improve the trans-

864. My transfers are made upon waxed glass developed with iron, *not toned*, and fixed with cyanide of potassium, transferred upon albumenized or gelatinized paper, according to the results required; the results are very clean, the tone a warm purple black, richer and brighter than I have ever got by a process which requires toning. The glass upon which the enlargement is made should be very perfect, without bubbles or scratches, waxed in the same manner as for carbon printing by double transfer, coated with an old ripe collodion, and sensitized in an old acid bath. The developer should be weak in iron, and strong in acid, both acetic and citric being used. With an excess of acetic acid a very warm tone can be obtained, but there is a loss of brilliancy; with excess of citric acid more brilliancy is obtained, but the tone is cold blue-black; in fact, a nice adjustment of the two is required to give just the proper amount of warmth without sacrificing brilliancy. It is mostly recommended to fix with hyposulphite, but I prefer to use cyanide, as it is so much easier to wash away, and any hyposulphite remaining in the print after transferring will, of course, cause fading. Do not develop fully, as you will find the development go on while washing. If albumen paper is to be used for transferring, it should be cut to the size of the plate, placed in a bath of methylated spirit for five minutes, laid upon the still wet collodion picture, and squeezed down. When dry, it will peel. If gelatinized paper is used, it must be soaked in warm water, and applied in the same manner.—George Croughton.

Iodizers for Transfer Collodion.—

1.—Iodide of Ammonium,	$1\frac{1}{2}$ grains.
Iodide of Cadmium,	$1\frac{1}{2}$ "
Bromide of Ammonium,	$\frac{3}{4}$ grain.
Bromide of Cadmium,	$\frac{3}{4}$ "
Chloride of Ammonium,	1 "
2.—Iodide of Ammonium,	$2\frac{1}{4}$ grains.
Bromide of Ammonium,	$1\frac{3}{4}$ "
Iodide of Potassium,	$\frac{3}{4}$ grain.
Bromide of Potassium,	$\frac{1}{4}$ "
Chloride of Ammonium,	$\frac{3}{4}$ "
3.—Iodide of Ammonium,	$1\frac{3}{4}$ grains.
Bromide of Ammonium,	$\frac{3}{4}$ "
Iodide of Cadmium,	$\frac{3}{4}$ "
Bromide of Cadmium,	$\frac{1}{4}$ "
Chloride of Ammonium,	$\frac{1}{4}$ "

One ounce of the collodion should contain any of the above formulæ. If the addition of, say, to thirty ounces of iodized collodion of No. 1 formula one drop of *aqua regia* be added, it will be found to answer admirably for opals. Methylated ether answers all requirements for this class of work, but it is much better to use alcohol than methylated alcohol, as many of the defects met with in the manipulation are mainly due to the injurious effects produced by methylated alcohol in the nitrate bath.

Collodion.—Six grains of cotton to each ounce of ether and alcohol in the following two

fers, but is better for the other work. Any good, rather old collodion will answer that will give fine details and not too violent contrasts. The plates must be carefully cleansed and prepared.

proportions: Two parts of alcohol and one part of ether in hot weather, and equal parts in cold weather.

The nitrate bath should not exceed twenty-five grains to the ounce of water, but will work well down to fifteen grains, and should be rather acid with nitric acid. In working, the most troublesome defects are white spots, black spots, and white streaks. The first are caused by the bath being saturated with iodide, etc., and can be remedied by adding to the bath one-third of its fluid bulk of plain water, filtering, and strengthening again to bring it to its proper strength. The second are caused, sometimes, by the bath being too strong for the collodion, and may be reduced. If that does not answer, add a little plain collodion to the collodion in use, and should this fail, try one drop of nitric acid to every twenty ounces of iodized collodion, adding at the same time a drop or two more of nitric acid to the silver bath. One or other of the above will invariably answer. White streaks are, like the first, due to the same cause, and will often appear in a new bath. In this case, add a little more iodide to the bath, filter, and add slightly more nitric acid.

DEVELOPER.—

Pyrogallic Acid, ...	3 grains.
Citric Acid, ...	6 "
Water, ...	1 ounce.
Methylated spirits to requirement.	

The above is for hot weather.

Pyrogallic Acid, ...	3 grains.
Citric Acid, ...	2 "
Water, ...	1 ounce.
Methylated spirits as required.	

This is for cold weather. Use Schering's pyro. The best results have been obtained by taking one ounce of pyro, dissolving it in boiling water, and adding the necessary citric acid to it, using this as a stock solution in the same proportions as above.

Development, although so simple, is probably the cause of many failures or objectionable results which are too often attributed to other causes. In very few processes can so great a latitude of over-exposure be kept under during development as in this. Take an ordinary square block of wood, nail a piece of thick leather at each corner, and the block can be levelled by the use of a few wooden wedges placed as wanted. If the plate exposed be placed upon this and is perfectly level, take care, in flowing on the developing fluid, not to wash off the free silver; or, in other words, to spill the developer from off the plate. The solution is left on the plate, and if it has been properly exposed, the image, after one or two minutes, will gradually appear if the negative was thin and weak. As soon as all the image has been perceived faintly, then proceed as follows: Pour off all the developer, and rock the plate to and fro. This will give a brilliant, strong, and clean image; whereas, if the whole liquid had been retained, the resulting effect would resemble the negative—that is, weak and flat; but should the negative be one in every respect suitable for enlarging, it is only necessary to watch the plate on the block and cut off a little sooner than the requisite force has arrived, as with the greatest rapidity of washing the developing action goes on slightly after the

365. After the enlarged positive is made, it is, as has been already stated, transferred to paper, or it may be some other substance, such as glass, wood, porcelain, metal, or fabrics. This operation is a very easy one, and resembles that described for making the glace prints in Lesson S. Of course there is room here, too, for care and thought, and failures will occur until some experience is had.

water is on. Great pains should be taken to be sure that no trace of the pyro is left on the surface before fixing, otherwise, the hyposulphite solution is rapidly discolored, and, of course, the plates fixed in a discolored solution cannot remain so clear and bright as in a perfectly fresh fixing bath.

Fixing Solution.—Use rather strong hyposulphite of soda. After fixing, it is again very necessary to wash well, and it is advisable, even after a very prolonged washing, to take the following precaution: In a weak solution of permanganate of potash immerse the plate, allow it to remain a few minutes, and then wash well afterwards.—X. Y. Z.

Any bath and collodion that works clear in the shadows will do; the collodion should be old, and the bath quite acid; the bath must be as weak as it will work with the collodion—we get the best results at about twenty-five grains. The developer must be pyro; a good one is as follows:

Water,	1 ounce.
Pyrogallic Acid,	5 grains.
Citric Acid,	3 "
Acetic Acid,	½ drachm.

Alcohol if necessary to make flow smooth. The positive should be timed so as to develop quite slowly; do not develop too far, or the whites will not be clear. It is not *necessary* to wash after developing; place in hypo and let it fix; but I wash a little, so as to keep in the habit, as, in using the iron developer, they must be washed; after fixing, they must be *well* washed, but be careful, or the film will loosen, the plate *not being albumenized*. To prepare the plate, polish with alcohol and water, then rub with a solution of wax, five grains; benzole, one ounce; this is necessary to enable you to strip the film off after it is dry.—J. H. Folsom.

365. After your transparency is fixed and well washed, your gelatinized paper (which, in the meantime, has been soaking in cold water a few minutes) is laid carefully on the collodion film, the water and air are squeezed out with a squeegee, not pressing too hard, the surplus edge of paper is cut off, and the whole left to dry, when, by cutting along the edge, a thin knife may be inserted under the corner, and the film stripped from the glass. To gelatinize the paper, dissolve by heat two ounces of gelatin to a quart of water; keep hot, and float the paper about three minutes and hang up to dry, when it is ready for use. Heavy Saxe plain paper will do, but there is a cheaper paper which is as good, or better, for this purpose, which you can get at any paper warehouse; the paper must be gelatined in cold weather or in the evening, or it will run; a large quantity can be prepared, as it will keep.—J. H. Folsom.

Gelatin Transfer Paper.—Plain Saxe or Rives floated on a solution of ordinary gelatin:

Gelatin,	10 ounces.
Water,	1 gallon.
Chrome-Alum,	¼ ounce.

Float a minute and a half, and hang up in a room of any temperature not lower than 65°.

366. The coloring upon the collodion transfer must be rapidly done, since the price at which they are sold in the market is extremely low. They are usually done in oil, and certainly he or she or it who colors them must be an illy-paid expert. The finest results are obtained by the use of crayon or India-ink, and when that is used the matter is not so difficult.

This will keep two months, or even for any length of time, by slightly increasing the amount of chrome-alum. To make it become attached to the plate it requires simply to be floated, face downwards, in water a short time previous to use, and squeegeed on as usual. The glasses for use can be cleaned in any way preferred, and then dusted on with talc, and the talc polished with a nice, clean, and thoroughly-dry leather. If the leather be damp, do not expect the paper to peel off the plate. Should, after all has been completed, the picture refuse to peel off the glass, add a few drops of glacial acetic acid to some water, and steep the back of the paper with this; it will readily peel afterwards. In hot weather it is often a good precaution to add one or two drops of glacial acetic acid to every pint of collodion; this is the best remedy against sticking.—X. Y. Z.

I prefer the "lime" or oxyhydrogen light for the lime, as it is of a fixed quantity; it soon pays for itself in preventing loss from under- or over-exposure. You have only to find the right time once and then go on forever, making only a little difference according to the density of the negative; whereas, if you use the solar light, the exposure may vary from a few seconds to any number of minutes. I use the mixed jet and keep the gases in galvanized iron tanks, in which the gas never goes bad. It is a pleasure to be able to make an enlargement at a few minutes' notice with certainty—night or day, of course, not making any difference. About one minute and a half's exposure in the lantern will be found sufficient, using the following developer:

Pyrogallic Acid, ...	40 grains.
Citric Acid, ...	20 "
Acetic Acid, ...	30 minims.
Alcohol, ...	*quant. suff.*
Water, ...	10 ounces.

One and a half ounces will cover a twelve by ten plate. As soon as the plate is well covered, pour off the excess, and begin to wash as soon as the image appears as you would like to see it when finished. Fix in a dish of hypo, wash well, and proceed to make another if you require it.—A. PHILBURN.

366. After the film is transferred to the paper, mounted upon stout card and rolled well, shake fine pumice-powder, sifted through two thicknesses of fine muslin, all over it, and with a light circular motion rub evenly all over till an even mat surface is obtained; wipe off all pumice-powder with a clean, soft linen rag. Now take one of Rowney's ever-pointed pencils, H, HB, and BB. With the BB strengthen all the dark touches—pupils of the eyes, line of eyelash, eyebrows, hair and drapery, etc.; with the H and HB mend all the patches in the face, and graduate all the shadows, working between the breaks in the photograph. If the operator cannot draw, it is best left at this; if he can, any amount of finish can be obtained—the whole face can be highly stippled with the pencil, the drapery hatched, and some bold hatching over the shoulders and upon the background will greatly add to the effect; but it is astonishing how much effect can be obtained upon a good, soft transfer with just the few bold firm touches with the BB, and the mending with the H and HB pencil.—GEORGE CROUGHTON.

LESSON Y.

WASTES AND THEIR WORTH.

367. So much of the precious metals is used in photography that it is important to guard against waste as much as possible. This waste occurs in two ways: First, by attempting to sensitize both collodion plates and paper without a knowledge of the strength of the solution used, thus wasting raw material; and, secondly, by allowing used solutions to run down the sink, and by throwing away scraps of silvered paper which could be burned, the ashes saved, and the silver obtained from them in

367. The method known as "volumetric analysis," applied to testing silver solutions in the usual way, requires the use of a burette graduated into cubic centimetres—a piece of apparatus easily broken, and which is hardly adapted to the wants of the ordinary dark-room, but, as the principle upon which it depends is extremely simple, the following modification of the process is offered, which it is thought will come within the practical working of almost every photographic laboratory. Before describing the method, it will be well to briefly explain to those not familiar with volumetric analysis the principle involved. When a solution of salt (sodium chloride) is added to a nitrate of silver solution, chloride of silver is formed, which, being insoluble, is precipitated at the same time the sodium nitrate (the other product of the decomposition) goes into solution. Sixty grains of sodium chloride are required to precipitate one hundred and seventy grains of nitrate of silver. If, therefore, one ounce of water held in solution one hundred and seventy grains of nitrate of silver, it would require just sixty grains of salt to precipitate all the silver as chloride; or, should the one ounce of water contain one-half the quantity of nitrate of silver (eighty-five grains dissolved), then thirty grains of salt would be required to effect the complete precipitation. From this it will be seen that the quantity of salt required to precipitate a silver solution depends upon the quantity of silver dissolved; and, therefore, to learn how much silver is held in solution, it is only necessary to find out how much salt is required to completely precipitate it. For this purpose a standard solution of salt is made, a given quantity of which will represent so many grains of nitrate of silver. The simple process suggested, based upon this well-known principle, is as follows:

First procure a one-ounce graduate, marked off in drachms; also one sixteen-ounce narrow-mouth, corked bottle, and one eight-ounce narrow-mouth, glass-stoppered bottle; this is all the apparatus required. Next take an ounce or more of common salt, and dry it in a clean dish over a gentle heat for an hour or more, until the little moisture it contains is driven off. When the salt is thus well dried and cool, weigh out exactly ninety grains on a piece of paper, and pour it into the sixteen-ounce bottle, taking care not to spill any; then add exactly fifteen ounces of water, common water will answer, but distilled or clean rain-

the crucible. It is therefore important that the photographer should know how to test the strength of his solutions, and how to save himself from loss by wastage. There are several ways of coming at the first, but the volumetric method is the best, and a simple means is given by a dis-

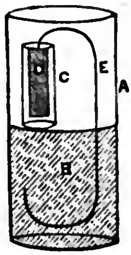
water is much better. Cork the bottle and shake it well until all the salt is dissolved. Label the bottle, "Standard salt solution for testing silver baths. Formula: Ninety grains of salt; fifteen ounces of water. Each drachm of solution represents two grains of nitrate of silver." Now, in order to make the test, proceed as follows: Measure out exactly half an ounce of the silver solution (the strength of which you wish to ascertain) and pour it into the eight-ounce bottle; rinse out the graduate twice, with about half an ounce of water each time, and pour these washings into the bottle with the half ounce of silver solution. Now add a few drops of pure nitric acid to the bottle, in order to render it decidedly acid to litmus-paper. Next pour into the graduate exactly one ounce of the standard salt solution, and add it gradually, a drachm at a time, to the bottle containing the silver solution. Put the stopper in, and shake violently for a few moments; the salt solution will precipitate the silver as chloride, and the shaking will cause the liquid to settle clear; add another drachm of salt solution, and shake as before; go on doing this until the silver solution begins to look milky after the addition of a drachm of standard solution, and does not settle out clear. This is the critical point, as nearly all the silver has been precipitated, and a very small quantity of the salt solution will now effect the complete precipitation. Add the solution now, a few drops at a time, shaking well after each addition; and when the test-liquid in the bottle no longer shows a cloudiness after the last addition, the operation is completed. To ascertain now the strength of the silver bath, it is only necessary to bear in mind how many drachms of the standard solution have been used in the operation. Suppose, for instance, it took exactly seven drachms of the salt solution to effect the complete precipitation, as each drachm represents two grains of nitrate of silver, seven drachms equal fourteen grains to the *half ounce*, or twenty-eight grains to the ounce. If the test is always made with half an ounce of bath, the number of drachms of standard solution multiplied by four will give the number of grains of nitrate of silver to the fluid ounce. Should it be found, in another case, eight drachms (one ounce) were not sufficient to throw down all the silver as chloride, then another ounce of standard solution is measured out and added, in fractions of a drachm at a time, until the desired result is attained. If in this case nine and a half drachms precipitate all the silver, then nine and a half multiplied by four equals thirty-eight, or thirty-eight grains of nitrate of silver to the ounce of bath. In order to obtain accurate results, two tests should be made—the first will give an idea about how much standard solution will be required for the operation; then the second test must be made with care at the end of the trial, adding the salt solution in portions of a few drops only at a time. As it is quite possible to read down to a quarter of a drachm on the graduate, the strength of the bath may be ascertained, at least within one or two grains to the ounce. There are a few points which, if observed, will add to the accuracy of the results: 1. In the first test, add the salt solution, half a drachm at a time, until the number of drachms required is known. In the second test, the standard solution may be added in greater quantity, until within a few drachms of the critical point; after that is reached add it only by drops, shaking well after each addition. 2. In order to drop the salt solution neatly, so that none of it runs down under the lip of the graduate (which would occasion loss and vitiate the results of the experiment),

tinguished chemist in the note appended. As to the saving of wastes, only a few practical hints will be given, since your dealer or chemist will supply you in pamphlet form, free, with much more elaborate instructions than comes within the reach of this work to give.

rub a little soft wax or tallow just under the lip, up to the pouring edge; by this means the liquid may be dropped without any danger of spilling. 3. In order to read the graduate correctly place it upon a level table, and have the sight upon a line with the markings. Owing to the adhesion of the liquid to the glass, it rises on the sides a little above the true level, and the readings should be made between the two liquid surfaces.—GEORGE BRINTON PHILLIPS.

To convert chloride of silver into a metallic state, procure a porous earthenware tube, such as is used in galvanic batteries; make a zinc cylinder to enter it, leaving a small space around it; to the zinc cylinder must be soldered a piece of silver wire; the chloride to be converted is introduced into a large jar, the porous vase is made to stand upon the surface of the chloride, and the silver wire is bent in such a manner that it lies at the bottom of the jar in the middle of the chloride. The jar is then filled with acidulated water, which passing through the pores of the tube attacks the zinc and creates an electric current; the silver in a pure metallic state deposits itself round the silver wire. The jar must be kept in a warm place, and not touched until every atom of chloride is converted. A, jar; B, chloride of silver; C, porous vase; D, zinc cylinder; E, silver wire. When terminated, it is not even necessary to melt the product in a crucible; it can be dissolved in nitric acid and crystallized.—E. STEBBING.

FIG. 110.



Almost every photographer has some special way of his own for saving silver from the developing solution, but I doubt if a more primitive or effectual plan has ever been hit upon than one adopted by a photographer, of no mean reputation, that I met during my travels this summer. The whole apparatus was nothing more than an old felt hat without holes, arranged upon a frame of four sticks over the developing tray, similar to a funnel. Plates were developed into the hat, which, from the porous condition of the felt, allowed all the solution to filter slowly through, but not before all of the silver had been precipitated by the continued action of the iron. After a season's work, the hat was burned and the silver recovered. Simple as well as effective appliances are what photographers desire, and this certainly deserves a trial, even at the sacrifice of an old felt hat.—J. C. BROWNE.

The greater part of photographers' residues are in the form of chloride of silver, which should be put dry into a large bottle, and a certain quantity of ordinary ammonia be poured upon them, and well shaken up every now and then. The ammonia will dissolve all the chloride. When the ammonia is saturated, decant it, and even filter it, and set it apart. Pour fresh ammonia upon the residues until all the chloride is dissolved out. It can easily be seen if the ammonia contains chloride by the following test: Take a test-tube, pour a few drops into it, then a little distilled water; pour into it a few drops of hydrochloric acid, and a heavy precipitate will be the result if it contains chloride of silver. When all the chloride has been dissolved out, put the ammonia into a large-mouth jar containing plates of sheet-copper. In a very short time the chloride will be reduced to a metallic state. It is then put into a crucible and melted. It can now be converted into nitrate of silver, which will be very pure and give excellent results.—E. STEBBING.

LESSON Z.

METRICAL MEASURING.

368. Had the publication of this work been delayed, say two years longer, perhaps it would then be possible to ignore the old systems of weights and measures entirely, and substitute those after the metrical system in their place. To do it now, would have caused an outcry against it, and a great deal of inconvenience beside. Hence the old system has been largely adhered to. But to be at least alongside with the tendency of the age, the following tables have been carefully prepared to enable American photographers to convert foreign photographic formulæ into such weights and measures as they are familiar with.

Table for Converting Cubic Centimetres into Fluid Ounces, Fluid Drachms, and Minims.

Cubic Centimetres.	Fluid Ounces.	Fluid Drachms.	Minims.	Cubic Centimetres.	Fluid Ounces.	Fluid Drachms.	Minims.
1 =			16	35 =	1	1	28
2 =			32	40 =	1	2	49
3 =			49	45 =	1	4	10
4 =		1	5	50 =	1	5	31
5 =		1	21	55 =	1	6	52
6 =		1	37	60 =	2	0	14
7 =		1	54	65 =	2	1	36
8 =		2	10	70 =	2	2	56
9 =		2	26	75 =	2	4	13
10 =		2	42	80 =	2	5	38
15 =		4	3	85 =	2	7	
20 =		5	25	90 =	3	0	20
25 =		6	46	95 =	3	1	42
30 =	1	0	7	100 =	3	3	3

1000 c.c. = 1 litre = 34 fl. oz. nearly, or $2\frac{1}{8}$ pints.

Rules for Converting the Centigrade Scale into the Fahrenheit Scale.—If above the freezing point of water (32°), degrees $\times$ 9 $\div$ 5 $+$ 32.

If below the freezing point and above zero, 32—(degrees $\times$ 9 $\div$ 5).

If below zero, —(degrees $\times$ 9 $\div$ 5).

Relation of Metrical Weights to Troy Weight.

Metrical Weights.		Equivalents in Grains.	Equivalents in Grains.
Milligrammes.			
1	=	.0154	1/65
2	=	.0308	1/32
3	=	.0463	1/22
4	=	.0617	1/16
5	=	.0771	1/13
6	=	.0926	1/11
7	=	.1080	1/9
8	=	.1234	1/8
9	=	.1389	1/7
Centigrammes.			
1	=	.1548	1/6
2	=	.3086	1/3
3	=	.4630	5/11
4	=	.6173	7/11
5	=	.7717	3/4
6	=	.9260	9/10
7	=	1.0803	1
8	=	1.2347	1¼
9	=	1.3890	1⅓
10	=	1.543	1½
20	=	3.086	3
30	=	4.630	4½
40	=	6.173	6
50	=	7.717	7½
60	=	9.260	9
70	=	10.803	11
80	=	12.347	12½
90	=	13.890	14
100	=	15.433	15½

Metrical Weights.		Equivalents in Grains.		Drm.	Grs.		Oz.	Drm.	Grs.
Grammes.									
1	=	15½	=	..	..		..	..	..
2	=	31	=	..	..		..	..	..
3	=	46	=	..	..		..	..	..
4	=	62	=	1	2		..	..	..
5	=	77½	=	1	17½		..	..	..
6	=	92½	=	1	32½		..	..	..
7	=	108	=	1	48		..	..	..
8	=	123½	=	2	3½		..	..	..
9	=	139	=	2	19		..	..	..
10	=	154½	=	2	34½		..	..	..
11	=	169½	=	2	49½		..	..	..
12	=	185	=	3	5		..	..	..
13	=	200	=	3	20		..	..	..
14	=	216	=	3	36		..	..	..
15	=	231	=	3	51		..	..	..
16	=	246½	=	4	6½		..	..	..
17	=	262	=	4	22		..	..	..
18	=	277	=	4	37		..	..	..
19	=	293	=	4	53		..	..	..
20	=	308½	=	5	8½		..	..	..
30	=	462½	=	7	42½		..	..	..
40	=	617	=	10	17	=	1	2	17
50	=	771½	=	12	51½	=	1	4	51½
60	=	926	=	15	26	=	1	7	26
70	=	1080	=	18	34	=	2	2	..
80	=	1234½	=	20	34½	=	2	4	34½
90	=	1389	=	23	9	=	2	7	9
100	=	1543½	=	25	43½	=	3	1	43½
1000	=	1 kilogramme = 32 oz. Troy.							

Table for Converting Millimetres into Inches and Fractions of an Inch.

1 Millimetres	=	1/25	inch.
2	"	= 1/12	"
3	"	= 1/8	"
4	"	= 1/6	"
6½	"	= 1/4	"
8½	"	= 1/3	"
9½	"	= 3/8	"
10½	"	= 5/12	"
13	"	= 1/2	"
15	"	= 7/12	"
16 Millimetres	=	5/8	inch.
17	"	= 2/3	"
19	"	= 3/4	"
21	"	= 5/6	"
22	"	= 7/8	"
23½	"	= 11/12	"
25½	"	= 1	"
51	"	= 2	"
76	"	= 3	"
101½	"	= 4	"
127 Millimetres	=	5	inches.
152	"	= 6	"
178	"	= 7	"
203	"	= 8	"
228½	"	= 9	"
254	"	= 10	"
279½	"	= 11	"
305	"	= 12	"

To reduce Millimetres to Centimetres, divide by 10.

1 Metre = 39.37 inches. 1 Kilometre = 0.62137, or 5/8 of a mile.

LESSON &.

CONCLUDING CONFAB.

369. Now, good fellows, everything must end, and this work must go the way of *all* things—it must end. All through I have endeavored to drop *myself* as much as possible and make the earnest ones of my co-laborers help me in these lessons in every possible way, giving them a hand in educating those humble enough to be willing to learn something. I feel entitled to address you familiarly, because many of you who will read what I have prepared, have borne with me for nearly eighteen years, and have learned to endure and be good to me. Again, I feel a little free, because my labor of months is nearly ended, a great weight is already slipping from my shoulders. I have left the library and the note-book and the shears and the parlor paste and the printer and the desk and have come down to the margin of the murmuring, never-resting sea, to give a

369. But I return to my point, of cheapness. You do not think that it would be convenient, or even creditable, for women to wash the doorsteps or dish the dinners in lace gowns? Nay, even for the most ladylike occupations—reading, or writing, or playing with her children—do you think a lace gown, or even a lace collar, so great an advantage or dignity to a woman? If you think of it, you will find the whole value of lace, as a possession, depends on the fact of its having a beauty which has been the reward of industry and attention. That the thing itself is a prize—a thing which everybody cannot have. That it proves by the look of it, the ability of its maker; that it proves by the rarity of it, the dignity of its wearer—either that she has been so industrious as to save money, which can buy, say, a piece of jewelry of gold tissue, or of fine lace—or else, that she is a noble person, to whom her neighbors concede, as an honor, the privilege of wearing finer dress than they. If they all choose to have lace, too—if it ceases to be a prize—it becomes, does it not, only a cobweb? The real good of a piece of lace, then, you will find is, that it should show, first, that the designer of it had a pretty fancy; next, that the maker of it had fine fingers; lastly, that the wearer of it has worthiness, or dignity enough to obtain what is difficult to obtain, and common sense enough not to wear it on all occasions.—John Ruskin.

It is an uncomfortable fact, that a wide-spread opposition against methods of education of photographers is felt in the ranks of those serving them with their supplies, and that this same feeling is met with to a considerable extent in the profession itself. Any one with enthusiasm enough to show a desire to raise higher the standard of our art-science is frowned upon, and thought to be more an enemy than a friend. Why it is so, is one of

tired brain a day of rest, which I promised it when I began. I have brought with me only a few sheets of paper, a stylographic pen, and the notes 3–6–9–, and when I make place for them my labor is ended.

Will my work serve you a good purpose? Will it help bear photography up, and *up*, and UP? As I sit here on the beach, I see the wild waves come up in bold platoons, hissing and roaring and dashing at my feet, and burrowing and tearing to ruins the sandy piles which, but a moment ago, I had made into picturesque compositions, taking much away with them as they depart again, but leaving some little for me to start a fresh ideal upon. And as I sit upon a spar of the old wreck which lies stranded away out there among the breakers (how bravely it stands their continuous shock), I dream over the endlessness of the work there is to do, and a messenger seems to come and hail me like a companion on a journey with words of good cheer. I am bidden to remember that my work will bear no iller fate than the sandy pictures bore. The waves of opinion, I am assured, will come up against it, and batter it to pieces and carry much of it out to sea, but it is true, *some* of it will remain to give pleasure and profit to less sentimental picture composers than I appear to be now. *Always?* I ask. And the answer comes, "Yes!" So then, good fellows again, with this hope, a few words more and then

those incomprehensible figures that meet us from time to time in our life experiences, and we guess in vain as to the use of their being. If it were not for a certain element of enthusiasm found in all of life's concerns, the wheel of progress would be blocked. As an outgrowth of the enthusiastic element permeating the profession of photography, a few earnest souls have laid the foundation of a great educational institute, and unaided bear the expense of opening up for those who are seeking knowledge in photography, both the practice and theory, a place where it can be obtained at small cost. It certainly holds out little inducement for pecuniary gain, and must be viewed in the light of higher motives; still, no reason exists why the promoters of this noble enterprise should not meet a fitting reward for their labor. The Chicago College of Photography has the proud distinction of being the first institution of the kind planted in America, and the second in the world. It promises rich returns to those who are deciding upon adopting photography for their life-work. It offers through competent instructors a practical knowledge of the art-science, and places the student, in a most thorough manner, in possession of the best methods at a small item of cost. It also serves to weed out incompetent help, for those wanting assistants will find in the graduates of this college a service that is of the best, the expense of educating having been paid by the employed, releasing them of the expense and annoyance of experimental and incompetent help. It will also take the photographer who may seek the advantage of learning the latest methods, or who desires to perfect some special branch, and for a small sum furnish the required knowledge. The arts, sciences, and various industries, which more and more are calling upon photography for assistance, will find in the college a ready means of giving them the knowledge they desire.—GAYTON A. DOUGLASS.

I am done. I have humbly tried, and earnestly, to instruct you how to become good photographers. After you have become such, and enter the art for a livelihood, there are a few things that must be exercised *continuously* by you. Do everything to educate yourself—to keep alongside, at least—and to promote the education of the fraternity. Help our college to grow; encourage reading and the study of the writings pertaining to the art; maintain your dignity and standing with your patrons; ask good prices, and despise all that is cheap and bad. A real good photograph should show that the photographer who made it was educated in all the intricacies and technicalities of his art. It should tell, moreover, that his helpers worked in harmony with him, and show in their work, too, the mind of the controlling head. It should be proof positive that the model has had full justice done to her charms, and that she possessed good sense enough to get and pay for the very best of pictures. I now yield the last words to three earnest friends of our art, and please to heed them. May photography ever be honored by us all.

The relations of the photographer to the public, and *vice versa*, I consider, and always have considered, to be purely mutual, from an artistic standpoint as well as from the business standpoint; and as we all have to live on and by what we do, the latter standpoint is the one a little stronger appealing to our consideration. In regard to the former, the artistic standpoint, I take it as granted that every one of us works as conscientiously and carefully as his abilities will admit him to do; but regarding the latter, why do we hear so many complain about—I will not exactly say bad business—but of low prices? Do not low prices in almost every locality predominate? and is it a stimulant for earnest workers in our vocation to go and offer to the public continually the fruits of their brains and talents at sham prices? Where do you think this will lead to? This leads unavoidably to self-degradation. And this brings me to the very point in which I would say the relations of the photographer to the public are misunderstood. You have lost your self-respect, and the public mean to do with you as they please, and not as you should do; for in your house and business your rules must stand, and you must abide by them, or you must bear the consequences—fall, and lose the so very necessary respect of the community. The words, "Guard your dignity!" have so often been printed in our photographic journals,—words full of good, very good advice. This is another point where the relation of the photographer to the public is seriously implied; but how many have heeded this advice? If you wish to be respected, make the public respect you for everything that you say, do, or they see about you. Be firm in what you transact with your patrons. If you say "Yes," be it yes, and if "No," be it no; in short, have *strict* rules for the transaction of your business, and adhere to them without faltering. Now if such rules were to be introduced more energetically in the photographic business, there would be far less complaint on the part of the photographers of losing the esteem of their patrons; for you will probably all admit that a man that stands boldly up for his principles stands a better chance to gain respect and confidence with his patrons than one who totters and trembles for fear of losing a dollar, and for that reason gives way to making all kinds of concessions—H. Rocher.

APPENDIX

TO THE

CHAUTAUQUA EDITION.

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370. SINCE the publication of the preceding pages, the art of photography has made some tremendous strides. The manufacture and manipulation of bromo-gelatine-emulsion dry plates has been very much modified since the publication of Lesson U, though the results are no better. Greater speed has been attained, which is sometimes an advantage and at other times a decided disadvantage, for it has led many a novice into the blunder of "working for speed" at the sacrifice of quality in result.

While all these changes were going on, some good and faithful plodders have occupied themselves in the endeavor to supply a substitute for glass. Their efforts have been attended by great success.

Again, in printing processes many new things have been worked out which simplify the operations and increase the pleasure of the worker in photography.

370. Up to within a comparatively short period, the general belief of the photographer was that the quicker the exposure the stronger must be the developer used, and in the hands of the veteran, beautiful negatives were and are produced, because his experience taught him what to expect and how to realize his anticipations. But we fear that many a tyro amateur, with his quick shutter or detective camera, failed to have his hopes end in fruition, and saw more than the first dozen of his very rapid plates ruined—either fogged by development, or so weak and thin that all the intensifiers that he ever read about would not bring them up to the desired density or detail. It was doubtless in great measure due to these failures, and consequent heartaches, that the second part of the question, "strong or weak?" made its appearance, and many amateurs plunged boldly into a series of experiments to solve the vexed question (especially vexatious to many) to their own satisfaction, even if they failed to convince others. As the subject stands now, it is not settled, but each side has its own band of earnest advocates.

It is not my purpose now to treat of all of these in detail. I shall select the best—the most practical—and thus inform the reader fully how to produce all the new things in photography, by the easiest and simplest means.

Very few persons, in these days of plentiful dry-plate factories, attempt to manufacture their own plates; therefore, I shall only treat of the manipulations.

There are two grades made by each manufacturer, as a rule—those working with ordinary rapidity and those which are as "quick as lightning." For almost all kinds of subjects, in the hands of the novice, the first are preferable. For photographs of animals and moving objects, and for marine views, the "quick" plates are the best.

Mr. C. Faber says, in a communication to the Belgian Photographers' Association, that this question has often been put to him, and that for the last three years he has found nothing that can be compared to the concentrated developer of Dr. Eder:

Neutral Oxalate of Potash	60	grammes.
Sulphate of Iron	20	"
Water	100	"

Neutral oxalate of potash is dissolved in boiling-water, and this solution is kept at a temperature between 194° F. and 203° F., while sulphate of iron is dissolved in it. It is then set aside for twenty-four hours, and the clear liquid decanted off the crystals that have formed at the bottom of the bottle, and is ready for use. He says that it is the most energetic developer for gelatino-bromide plates. In the next sentence he says: "If the action of this developer is found to be too rapid, it suffices to dilute it with more or less water. By adding an equal volume of water, we obtain a bath which acts still more rapidly than the developer made by the usual formula."

That the advocates for a weak developer are numerous, can assuredly be seen in the current photographic literature of the day, and certainly many beautiful results of their work are proudly exhibited to be admired, as they deserve to be. Quite recently, the advantage of using two solutions, instead of a combined one, has been strongly advocated by many earnest workers and experimentalists, who claim for this method a greater control of the process of development, and a certainty of results not to be obtained by any other.

A sort of cross, or half way, between the one and two solutions, has also been proposed That is, by giving the plate a bath of water and then placing it in a combined solution. Mr. Eugene Albert, in a plea for over-timing, says that when he cannot over-time—or, in other words, when he makes a rapid exposure—that after letting the plate lie in plain water for ten minutes, covering it up, of course (a decidedly necessary procedure), he then washes it by pouring water over it, and then puts it into the combined developer. He further says that it is strange, but it is a fact, that the washing, after removing the plate from the plain water, facilitates the development.—Dr. John H. Janeway.

871. Developers.—Among the many developers which have been suggested, the "pyro" and the "oxalate" formulæ have the most advocates, and they are modified according to the taste and notions

871. *Simple Developer.*—Take 1 ounce of crystalline carbonate of soda, and 2 ounces of sulphite of soda, and dissolve in 64 ounces of water; this stock solution keeps well.

To develop, take enough of the above to cover the plates, and add about two grains of pyro to the ounce; lay the plate, film side up, in the tray, holding the same in your hand, pour on the developer, and gently rock it until the details are well out in the shadows, and the high-lights strong enough. Wash the negative well under the faucet, and lay it in the fixing solution of hyposulphite of soda, and alum enough to prevent frilling. I dissolve the hyposulphite in a bottle by itself, and then add a sufficient quantity of the alum solution. In this way we have the negative developed and fixed almost as quick as by the wet process. —Thomas Pray, Jr.

If you will once try the following formulæ for a concentrated developer by Mr. G. Cramer, you will like it:

Sulphite of Soda	90	grammes.
Bromide of Ammonium	15	"
Bromide of Potassium	45	"
Pyrogallic Acid	60	"
Distilled Water	960	"

When the solution is completed, add:

Sulphuric Acid	120	drops.
Liquor Ammonia (strong)	90	c.c.
Water in sufficient quantity to bring up the whole to the volume of	1200	c.c.

For use, take one part of this solution diluted with eleven parts of water.

Usual Pyro Developer:

No. 1.—	Strong Liquor Ammonia	1¾	ounces.
	Bromide of Potassium	240	grains.
	Water	80	ounces.
No. 2.—	Pyrogallic Acid	30	grains.
	Water	10	ounces.

In case of an ordinary exposure, mix equal volumes.

Pyro Developer.—Pyro Solution.

Warm Distilled Water	2	ounces.
Sulphite of Soda (C. P.)	2	"

Dissolve; and when cold, add—

Sulphurous Acid	2	ounces.
Pyrogallic Acid	½	ounce.

Potash Solution.

A.—	Water	4	ounces.
	Carbonate of Potash (C. P.)	3	"
B.—	Water	3	"
	Sulphite of Soda (C. P.)	2	"

of their various advocates, and to suit the different brands of plates. Each box of plates is accompanied by the formula of the manufacturer, and it is the fairest way to follow the same. Some modifications have

A and B are now combined into one solution, which will measure between eight and nine fluidounces. To develop an 8½ x 6½ plate which has had a drop-shutter exposure, take water 3 ounces, and add thereto half an ounce of No. 1 and 3 drachms of No. 2 of the potash solution, increasing the latter to 5 drachms in case the image hangs back. For a plate which has had the proper exposure, or which has been somewhat overexposed, add to the 3 ounces of water 3 drachms of No. 1 and 1 drachm of No. 2. After a minute's time, if the image fails to appear, add a second drachm of the potash, repeating the additions at intervals of a minute until developing commences.—F. C. Beach.

Oxalate Developer. No. 1.—Saturated solution of neutral oxalate of potash. To 1000 parts of this add 3 parts saturated solution of bromide of ammonium.

No. 2.—Saturated solution of sulphate of iron. To 1000 parts of this add 2 parts saturated solution of tartaric acid.

For use, take 4 parts of No. 1 to 1 part of No. 2. If the picture is underexposed, add a little more of No. 2.

The Old Sulphite Developer.—

No. 1.—Sulphite of Soda.	4	ounces.
Water	40	"

Dissolve; then add sufficient of a saturated solution of citric acid to produce a slight acid reaction upon litmus-paper; now add one ounce of pyrogallic, and make up bulk to 54 ounces with water. This gives a solution, each ounce of which will contain about eight grains of pyrogallic.

No. 2.—Ammonia 0.880	1	ounce.
Potassium Bromide	180	grains.
Water	40	ounces.

Equal parts of this will give a four-grain pyrogallic solution, a strength which is a good average.

The Sulphite Developer.

No. 1.—Potassium Carbonate	45	parts.
Sodium Sulphite	12	"
Water	1000	"
No. 2.—Pyrogallic Acid	12	"
Sodium Sulphite	24	"
Citric Acid	2	"
Water	1000	"

For a normal development, equal proportions of No. 1 and No. 2 are used.—L. Warnerke.

Soda Developer, with addition of Ammonia.—Prepared as follows:

A.—Distilled Water	1500	cub. cents.
Neutral Sulphite of Soda	100	grammes.
Pyrogallic Acid	15	"
B.—Distilled Water	500	cub. cents.
Pure Crystallized Carbonate of Soda	50	grammes.
Strong Ammonia Solution	2½	cub. cents.

been made since Lesson U was printed and selections from Germany, France, England, and America follow, in order that there may be a variety to choose from.

372. FILMS.—Among the substitutes offered for glass, *negative films*, with or without a paper or other support, have met with the most favor

Both solutions are to be kept in well-stoppered bottles. A will keep good for two or three weeks; B for several months.

For use, one mixes 100 parts of A with 20 parts of B, and as this mixed developer will keep for a day in a well-stoppered bottle, sufficient for a whole batch of plates may be mixed at once. In this developer the image should appear in ten to fifteen seconds if the exposure has been correct, and the development should be completed in four to six minutes.

If overexposure is feared, the developer is diluted with half its bulk of water, or a commencement should be made with some of the developer which has been used for previous plates.

If, on the other hand, it is desired to force the development, there are added to each 100 cubic centimeters of the developer 2 to 5 drops of the following solution (C):

C.—(*Accelerator.*)

Strong Ammonia Solution	50 cub. cents.
Water	150 "

The developer may also be made more active by increasing the proportion of B.—DR. J. EDER.

To Remove Hypo from Films.—In the *Moniteur*, M. Felisch recommends that in order to render harmless any traces of hypo that may remain in a plate after washing, it should be laid in an iodine bath, consisting of equal parts of iodine and iodide of potassium, dissolved in as much water as will make the solution the color of port wine. When removed from the solution the plate must be well washed again. To the foregoing the editors of the *Mittheilungen* add that they have often recommended the use of such a dilute solution of iodide—say 1 : 100—but remark that the plate should not be left too long in the iodine bath, otherwise part of the silver will be converted into iodide of silver, and for that reason they willingly use the iodine solution as a reducing medium in preference to cyanide of potassium.

I may here relate a little incident which occurred a few days ago in a studio of a first-class photographer. Watching him developing a plate, soon after the solution was poured on a slight scum came on the developer.

"A dirty dish," I remarked.

"Impossible," was the reply, "you saw me rinse it well under the tap."

"Very well," I said, "before developing the next plate try rubbing your dish with a stiff brush and a little dilute nitric acid, and wash well with water and you will not be troubled with scum on your plates."

He took my advice, and having since followed it, that trouble disappeared. Rinsing a dish with water is very little good without a little elbow-grease as well.—WILLIAM ENGLAND.

372. Development is carried on exactly as for the dry plate. The same dishes, the developing solutions, are familiar to every one. Either the pyro with sulphite and carbonate of soda, as described further on, or the usual oxalate of potash and iron, may be used with uniform success.

Fixing is accomplished with hypo, as usual, and washing, just as you would silver prints—

and the most success. These films are supplied both in sheets or in continuous rolls, the former being backed while in the camera by a "carrier," and the latter, wound on spools, are carried across the camera-front by means of a very ingenious roll-holder. Films are also supplied upon

that is, several at once. This also applies to fixing and development, as no injury to the film results from their passing over each other during any of the operations, if ordinary care is used to prevent bubbles of air remaining between the sheets.

In short, the operations may be described in their order, thus:

Exposure—Either with the roll-holder or the film-carriers, which may be purchased of any dealer.

Time may be determined by the usual tests; as a rule, less than is generally given a plate will suffice.

Development.—After your sheets have been carefully cut off at the regular distances, marked by the punch in the roll-holder, or on removal from the carriers, they are laid carefully in a dish of clean water of sufficient size to accommodate the number to be treated; care must be taken to avoid the formation of air-bubbles on the film while in the water; it is well to pass a camel's-hair brush, or the hand (if clean and soft), gently over the surface, to remove any that may appear. The object of placing them in water is to saturate the paper, and thus admit of its lying flat in the developing tray.

The formula for development comes with each package, and should be made as directed, so far as composition is concerned. Of course, there can be no such thing as a cast-iron rule for development, which requires modification with subjects that vary in character and timing, but the following may be relied upon to work well in the majority of cases:

Solution No. 1, as described in formula	1 ounce.
Solution No. 2, as described in formula	1 "
Water, as described in formula	4 ounces.

The addition of about half an ounce of old developer to the above gives clearness and brilliancy to the shadows; it seems to have a ripening effect.

Now lay a negative sheet in the developing tray, and let on about two ounces of water from the tap; this floats the sheets and prevents the paper sticking to the bottom of the dish, which would occasion uneven development, as this goes on from both sides. Now pour in your developer, and rock the dish sufficiently to cause a uniform mixture of the water and solution. Development will commence in about ten seconds, perhaps sooner. This varies with temperature and character of picture. If overexposure is indicated use the bromide solution as published in formula. If underexposed, increase the proportion of soda. Use judgment above all things, and you will be rewarded with success. The intensity is judged by looking through, as with a negative on glass, and should appear a trifle stronger than in the latter case. The rest of your sheets may be placed successively into the developer, and as many treated at once as you feel confident you can handle successfully. As each in turn indicates full development, transfer to a separate dish, for washing, which should take about a minute. Next place in a solution of alum as directed, for, say, half a minute, and then transfer immediately to the hypo solution. The strength of these two solutions is not important, provided you have neither too weak.

When fixed, which is judged by transmitted light, place in your washing-tank, or a dish,

cardboard and upon sheets of insoluble gelatine and collodion combined; but, as yet, such have not been brought into general use.

Full instructions for using the films are given in the notes below.

They entail quite a variety of changes in manipulation, and also cause

and pass running water over for fifteen minutes, or give four or five changes of water at intervals of ten minutes.

Drying.—Provide yourself with, say, half a dozen clean glasses (a size larger than the negatives), which should be wiped on both sides with an oiled rag and subsequently rubbed quite dry. Your negatives can now be drawn on to the glass, face down, one on either side, and squeezed with a velvet rubber squeegee, which may be had of any dealer. Set up in a rack in the air, and they will dry rapidly; then remove by a touch.

Oiling.—Make a pad of manilla paper (say six thicknesses); on this lay your negative, face down, and smear the back with castor oil; use plenty of oil—a dessertspoonful at least to every 5 x 8 negative. Now, with a polishing iron with rounded edges, such as is used in laundries (quite hot), smooth the negative with a uniform pressure, following the path of the iron with a sponge or rag saturated with the oil. Proper oiling will be indicated by a uniform dark color all over the back; no spots or mottling should be seen; if any are seen, continue heating and rubbing on oil till they disappear.

Retouching may be accomplished from either side, and takes with great readiness.

Printing is done by placing on a clean glass in the printing-frame, after rubbing off all surplus oil, and, if it needs it, removing with a tuft of cotton and alcohol any greasiness on the surface, being careful, however, to allow none of the spirit to get on the back.—DAVID COOPER.

When *thoroughly* fixed, which is shown by the negative being of a uniform color, looking through it, or simply showing the grain of paper with no opaque spots, wash and immerse in a saturated solution of alum for five minutes. Wash thoroughly and squeegee face down on a sheet of ebonite. When thoroughly dry it will peel off, giving a beautiful glossy face. (I prefer using the alum solution *after* fixing, as it gives a clearer and *cleaner* negative than when mixed *with* the hypo.) The negative will invariably curl *face in* on being lifted from the ebonite, and may be straightened by the scraping action of a ruler applied to the back.

Lay the negative on a sheet of glass with a piece of clean paper between the negative and glass. Apply the ruler, the corner behind the ruler being lifted as the ruler is passed along. When straight, lay face down on a piece of smooth pine board (with a piece of clean paper on it), and tack the four corners with thumb tacks. Apply the "translucine" or oil, and hold over the oil-stove, keeping the negative in motion till it presents a uniformly dark color all over. (The board keeps the negative from curling, as it *would* do if not tacked to the board when heat is applied.) When cool repeat the operation. I repeat it because one is then *sure* it is transparent, and it takes but a moment to do it. When *cool* the second time, wipe off the surplus oil with a clean rag. They can be retouched from either side. If from face, I apply the retouching fluid with the ball of the finger, same as with a glass negative. If from back no preparation is necessary; simply use a harder pencil.

I keep the negative in place in the printing-frame by tacking the corners with small pieces of gummed paper. For copies they are *immense*, as one can do four times the amount of retouching that can be done on glass—working out backgrounds, etc. In storing away for

the negative maker to hit upon some new plan of storing the treasures of his camera, because films cannot be held in racks or in ordinary negative boxes used for glass.

They should be kept flat and under pressure.

future use I oil a piece of paper in the same way I oil a negative, and place it between two negatives (back to back). This keeps the negatives saturated a long time, not allowing them to dry out. It is easier to oil the separating paper, than it is to have to *re-oil* two negatives. For all sizes from 5 x 7 up, they are *grand*. For enlarging with bromide paper they require about three times as long an exposure as a plate—W. B. GLINES, in the *Philadelphia Photographer*.

For Eastman's Negative Films I find that the best formula for devoloping is that given by Mr. Eastman in his instructions; here it is:

No. 1.—Sulphite of Soda	6 ounces.
Distilled or Boiled Water	1 quart.
Pyrogallic Acid	1 ounce.

Dissolve the sulphite first, and then add the pyro.

No. 2.—Carbonate of Soda (*pure*)	½ pound.
Water	1 quart.

To develop, pour into a clean tray the following:

No. 1	1 ounce.
No. 2	1 "
Water	1 "

Immerse the exposed film in a tray of clean, cold water, and with a soft camel's-hair brush gently remove the air-bells that cling to the surface of the film. As soon as limp, remove the film to the developing-tray, and proceed with the development the same as with a dry plate. I go over the film with a camel's-hair brush whilst in the developer, and I think the result pays for the little extra trouble incurred. The image should commence to appear in ten or fifteen seconds. If the light comes out slowly, and with no detail in the shadows, add, not to exceed one ounce, of No. 2. If the image appears too quickly, add from ten to twenty drops of the

Restrainer.—

Bromide of Potassium	1 ounce.
Water	6 ounces.

Keep this in a dropping-bottle, consisting of an ordinary bottle having two notches cut lengthwise in the cork on opposite sides.

The film may be examined from time to time by transmitted light by holding it up by the corners. When sufficient density is obtained, wash the film in two or three changes of water, and then immerse in the

Fixing-Bath.—

Hyposulphite of Sodium	4 ounces.
Water	1 pint.

Mix fresh fixing-baths for each batch of negatives. Use no alum in fixing-bath, or, indeed, at any time with these films.

The want of a means to do this has already been supplied by the ingenious device of Mr. Frank G. Dubois, an amateur photographer—a closed case with interior contrivances, by the help of which the film negatives or unmounted prints from them may be filed away "alphabetically" and on their edges, kept clean under pressure, and in shape for easy finding.

Thus much for negative making.

Films fix quicker than glass dry plates, and the completion of the operation can be ascertained by the even, translucent appearance from the back while lying in the bath, or by examination by transmitted light. After fixing, wash in several changes of cold water, the longer the better, and the film is then ready for transferring to its final support.

Coat a clean glass plate, polished with French chalk and, say, one size larger than the film, with plain collodion; well wash until all greasiness is removed. Lay the film negative face downward in a tray of cold water, and slip the glass plate, collodion side up, under it. Grasp the film by one edge of the glass and lift from the tray, allowing the water to drain from the side furthest from you. All surplus water can now be removed by the scraping action of a rubber squeegee, and the plate supporting the film set to soak in a dish of warm water, increasing the temperature until the paper commences to blister. Lift one corner of the paper with the point of a pin, and gently pull it off from the film, which will adhere to the collodion on the glass. Remove from the film with warm water all traces of the soluble substratum which was between the paper and the film.

The image-bearing film is now on the glass, with the paper removed. If intensification should be necessary, the operation can be performed in the same manner as with glass dry plates.

Intensification:

Mercuric Chloride	1 part.
Potassium Bromide	1 "
Water	50 parts.

Allow the film to remain in the above bath until it is thoroughly whitened, the bleaching being complete; the mercuric solution is rinsed off, and the negative is immersed in a mixture of equal parts of a saturated solution of sodium sulphite and water; the darkening action will be seen to take place steadily and slowly, just as when ammonia is used. The negative must be well washed, and is now ready for strengthening the film by adding a sheet of gelatine "skin." I prepare these skins any length of time beforehand, and keep them between the leaves of a book; they are thus always ready for use. I am indebted to Mr. Ernest Edwards, of the Photogravure Company of New York, for the manner of preparing these skins.

Take as many sheets of thick glass, with ground surface, as you wish to make skins; polish well with French chalk, and flow with the following solution:

Gelatine (Nelson's, No. 3)	1 ounce.
Water	10 ounces.
Glycerine	2 drachms.

Set on a level place to dry. They may be made in large sheets and cut up for use.

Take a piece of skin prepared as above, the same size as your negative film, and put it into a tray of clean, cold water, and as soon as limp lay it upon the negative film (already held

373. BROMIDE PAPERS.—The methods of printing, as detailed in Lessons M to S, inclusive, all remain about the same, with little or no changes. The new departure has been in the direction of permanent bromide paper, which is extremely sensitive, and, because of its matt surface, is preferred by the "æsthetic" printer. Another thing in its favor, besides the ease with which it may be printed, is the facilities it offers for enlarging upon it from small negatives. The paper is obtainable in sheets and in continuous rolls, ready sensitized. The prints may be made in any sort of light—even by moonlight. After exposure under the negative, the finishing is done by development as detailed below.

The extreme sensitiveness of this paper has been utilized by science in divers ways: medicine uses it to ascertain the presence of subtle poisons, observatories to register the atmospheric changes, which previously it had not been possible to do, etc. In photography it is certain that it can

on the glass by the collodion) and press out all surplus water with a rubber squeegee; place in a rack to dry. When dry, run a knife around the edge and lift the film from the glass. It will be found to be perfectly flat, and will remain so. The collodion acts as a varnish.

By using ground-glass for preparing the gelatine skins a matt surface is given, and so one gets a splendid tooth for retouching if any is required, and it also softens the prints. If a matt surface is not wished, then the skins should be prepared upon plain glass. When attaching the skin to the negative film, be careful to place the glazed side next the film.

An objection may be raised to the use of collodion. If so, all that would have to be done would be to wax the temporary glass support with the following solution:

Yellow Beeswax	1 drachm.
Benzole	3 ounces.

Then proceed as though the plate had been collodionized. I prefer the collodion because it acts as a varnish for the negative.—"KEHAMA," in *The Philadelphia Photographer.*

373. Last week I made several 20 x 24 prints from negatives of about two inches with a Ross C. D. V. lens, smallest stop, exposure ranging from 8 to 25 seconds. They can be made with an oil light, but the exposure would be of course so much longer, according to the brilliancy of your light.

Any one who has not a lantern, can easily fit up an apparatus which will answer the purpose just as well, with considerably less expense. I made one with a packing box, a condenser, a coal-oil lamp, and a few carpenter's tools.

But I think the best result, if you do not want to enlarge to more than 10 x 12, is by the negative process, which I will now proceed to describe.

The most important part of this method is the transparency from which to make the negative. My experience, which extends over many years, has proved to me that this transparent positive should be the full size you wish the enlargement to be. In the first place, it is all important that it should be fully exposed, the least trace of underexposure being fatal to good results. Next, it should be developed in very weak solution, and certainly not hurried in

render great service when it is necessary to produce a great number of prints in a short space of time. One can, in a few minutes, produce alone, by gaslight, forty prints from the same negative. The paper is placed under a negative in the pressure frame, exposed to gas or any other light, developed with oxalate and iron, then fixed. The operation lasts from five to six minutes, whatever may be the number of prints.

Thus obtained, these prints, although strong, have the softness of a crayon drawing, together with photographic delicacy and preciseness.

For enlargements, also, the gelatino-bromized paper has considerable value. With the ordinary processes, several difficult operations are

development; and the development should be pushed till there are very few points of bare glass, and those only in the highest lights. The developer I used for the transparency I have here, was made up as follows:

No. 1.—Carbonate of Potassium		3 ounces.
	Water	12 "
No. 2.—Sulphite of Soda		4 "
	Citric Acid	60 grains.
	Bromide of Ammonium	40 "
	Pyrogallic Acid	1 ounce.
	Water	12 ounces.

Of these two solutions, I use equal parts at the rate of one drachm of each to four ounces of water. If it should act too quickly upon the exposed plate, a few drops of a 60-grain solution of bromide of ammonium are added. If not quite enough, a few drops of the potassium solution and more water are added. It is, as I have said, best to expose fully and develop hourly with plenty of water. When finished, fix in fresh hypo, and, after washing for a few minutes, clear in the following solution:

Alum	1 ounce.
Citric Acid	1 "
Sulphate of Iron	3 ounces.
Water	20 "

Let it stay in this from thirty seconds to two minutes, till all yellow color is gone; wash well in running water for at least one hour.

Having got the transparency the size you wish your enlarged reproduction to be, you must make your negative by contact. The first objection to that will be that you cannot get actual contact, the glass upon which the average dry plate is made being anything but flat. If the exposure is made in diffused light, that objection would be fatal, the loss of sharpness being very considerable where contact has not taken place. But my method is this: I put the transparency into the holder face inwards, then place a dry plate upon it, film side, of course, against the film side of the transparency, adjusting the camera with the lens pointing toward a window, and put between the window and the lens a sheet of ground-glass; pull out the bellows to the fullest extent, and put in the holder with the transparency and sensitive plate. You have now through your lens direct rays of light of more or less intensity, according to the stop used, and can in this way time your exposure to a nicety; and although your plates

indispensable to obtain an enlarged print. First, it is necessary to print by contact or to enlarge slightly, either a gelatino-bromized, or chlorized, plate, or collodion plate, or a positive by transparency, from which is obtained a large negative to be used in printing; finally, the enlargement, either with carbon or on albuminized paper. With gelatino-bromized paper all these operations are done away with. It is the little negative itself that gives the enlarged picture. Of course, an enlarging camera is necessary.

And yet, albumen-paper printing will always have its adherents—unless, indeed, a substitute be found that will closely imitate its results.

374. Positives.—Photographic positives, such as transparencies for windows and for the magic lantern, are very popular, and continue to be made by methods given in Lesson W. A few more hints are given here.

And the almost universal use of the bromo-gelatine-emulsion plate for negative making, causing all who could to discard the nitrate of silver bath or "wet" method, has encouraged the introduction of another process for the production of positives in a quick way, and by the use of

may not be in actual contact over three-fourths of their surface, there will be no loss of sharpness; to try this, I have separated the two plates with pieces of thick card, and still no loss of sharpness; in fact, before dry plates were used, I had made hundreds of wet-plate negatives in this way from transparencies where the two plates were separated by corner pieces of stout silver wire.

The directions given for developing the transparency must be followed in developing the negative from it, being always careful to avoid underexposing.—Geo Hanmer Croughton, in the *Philadelphia Photographer*.

374. All must admit that in point of delicacy of gradation and minuteness of detail, a collodion positive on glass is as far superior to a paper print as a copper-plate engraving is to a wood-cut. Were it not for the facility of reproduction, paper prints would probably never have ousted the collodion positive from public favor.

It may interest many to know that pictures of almost precisely similar character may be obtained from ordinary bromo-iodized gelatine plates by the adoption of the foll wing treatment: Any ordinary dry plate is exposed in the usual manner, but for about half the time required for a negative. It is then developed with a ferrous-oxalate developer, made up as follows:

Ferrous Sulphate (saturated solution)	1 part.
Potassic Oxalate " "	3 parts.

Pour the oxalate solution into a measure glass, then the ferrous-sulphate, after which add one or two drops of saturated solution of potassium bromide to each ounce of the mixture—not more. Develop carefully until the picture is all visible on the upper surface, then stop the development by washing in water. Fix. After fixing, alum the plate, if necessary; then rinse once with a very weak solution of chloride of lime to remove any hypo. After this the plate may be brought to the light, and immersed in a solution of bichloride of mercury, twenty

which those who are asked for a single picture may produce it independent of the bath. I allude to the new Argentic positive process, by the use of which pictures are obtained on an emulsion coating upon a japanned iron plate. The manipulations are easy, the results are soft, and they will become more and more popular as their manipulation and manufacture is improved.

Of the many new and beautiful methods of photo-mechanical printing, only mere mention need be made here, as they are not available for the general reader of PHOTOGRAPHICS. Proofs of their excellence may be found in the current photographic magazines. Our appendix already contains enough to enable the reader to produce "all the new things in photography" worth his attention.

375. In apparatus, instruments, and appliances the changes have been infinite, so to speak. You must consult your dealer, whoever he may be, always remembering, that if you are in earnest with photography, "the best is the cheapest."

grains to the ounce of water, until the picture has become quite white. Again the picture must be washed to remove excess of bichloride, and when dry may be varnished and backed up with Brunswick black, as is usual with collodion positives.

This process is invaluable for securing rapid pictures, and may often be used where too short an exposure has been given to insure a good printing negative, since from the positive a splendid camera copy can be obtained, and intensified as a negative. This process may also be of service to our peripatetic brethren, who are industriously trying to get a living by taking rapid and cheap positives of "'Arry" at the sea-side.—S. BOTTONE.

Almost any ammonia developer may be used successfully with the Argentic plates, but it is claimed that greater rapidity and more uniform results are obtained by using the Phœnix stock solution.

The formula is this:

No. 1.—Pyrogallic Acid	. . . .	1 ounce.
Water	. . . .	12 ounces.
Citric Acid	. . . .	30 grains.

No. 2 Phœnix stock solution. (It is important that No. 2 be kept well corked.)

Developer.—

Water	. . . .	4 ounces.
No. 1	. . . .	2 drachms.
No. 2	. . . .	4 "

This mixture may be used over and over, but each time will work slower.

An important thing in this new picture is to secure soft and pure whites. To do so, the development advised must be followed carefully.

The developing should be discontinued as soon as the outlines of the picture are fairly observable.

They should be permitted to remain in the fixing-bath until every trace of the bromide solution is eliminated.

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